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Mitigating Terror and Avoidance Behavior through the Risk Perception Matrix to Augment Resilience

Ben Sheppard

Abstract

Terrorism is a psychological “mind game” with terrorists and leaders of the targeted society competing to influence and control the terror generated. While terrorists look to maximize their terror, government and public health entities seek to blunt fear and adverse avoidance behaviors that may ensue amongst the public. Drawing upon case studies, the paper employs the risk perception matrix from the field of risk analysis to map and compare the degree of dread risk created by different types of terrorist attacks (CBRNE); and the interplay of terrorism and measures society can undertake to mitigate terror. Case studies include the Second Intifada in Israel, the 1995 Sarin attacks in Tokyo, the London 2005 transport bombings, and 9/11. The paper demonstrates how the risk matrix can provide the public and emergency planners with context to reduce dread, fear and associated adverse avoidance behavior, and how to use information from previous events to guide future planning to augment resilience.

KEYWORDS: terrorism, risk perception, risk communication, coercion

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Introduction

Terrorism is a psychological “mind game” (Fischhoff, 2006). The terror of terrorism is interspersed with threats and attacks that seek to coerce the targeted populace and their government to alter behavior in line with the perpetrators demands (Freedman, 2005). Critical to effective emergency planning and long term recovery is understanding the public’s likely behavioral responses so as to design effective risk communication strategies that augment societal resilience. Risk analysis from psychology provides valuable approaches to meet this challenge: risk perception, risk communication, and the social amplification of risk. The field of risk perception is suitably positioned to explore the societal consequences of terrorism and has done so with increasing depth and breadth since the September 11 attacks (Slovic, 2002; Burns and Slovic, 2007).

The next stage for risk analysis is to explore and better understand how its tools can augment societal resilience. This has gained greater urgency following the National Research Council’s critical review of the Department of Homeland Security’s (DHS) risks analysis processes. The reports released in 2010 strongly recommended DHS formulate a “well-developed risk communication strategy” to “address the deficiencies to adequately understand the social and economic impacts of terrorist attacks” (NRC, 2010). The risk perception matrix that contextualizes the public’s perceptions to natural and manmade risks offers a suitable way to better understand, explore and map how terrorists may seek to increase the dread risk to maximize the terror generated, and how governments can mitigate the terror to augment resiliency.

Resilience is better characterized as adaptability rather than stability, whereby resilience is a process of “bouncing back” from harm rather than immunity from harm (Norris, 2009). Fostering resilience and responsibility to disasters enables communities to withstand extreme events with a tolerable level of loss (Mileti, 1999). Schoch Spana (2003) notes that public health professionals and emergency planners should “not only anticipate and protect against the negative psychological and social repercussions of terrorism, but also enhance positive public responses”. Anticipating the likely adverse reactions is necessary for developing effective risk communication to mitigate their occurrence and severity (Schoch Spana, 2003).

This paper builds on the Homeland Security Institute’s (HSI) resilience report that conceptualized resilience as comprising of two key elements - hard aspects (institutions and infrastructure) and soft aspects (individuals and communities) (HSI, 2009). The hard aspects include the robustness of structures (e.g., buildings, bridges), government continuity, transportation, communication and energy networks. Soft aspects encompass the capacities of individuals and communities to be self-sufficient, adapt, and critically, develop psychological

toughness. Collectively these elements augment prevention, protection, response and recovery activities. Linking together these sets of adaptive capacities can then provide, according to Norris et al (2008), a “positive trajectory of functioning and adaptation after disturbance”. Achieving psychological toughness, as described in the HSI’s resilience report requires coordination and planning across the individual and community levels to government authorities and the private sector (Norris et al, 2008).

Risk analysis provides a suitable arena to frame and develop strategies to augment resilience. This article examines how the risk perception matrix can advance our understanding of the influence different types of terrorist attacks can have on dread and fear, and second, the types of adaptive and avoidance behaviors that may ensue. This paper draws upon case studies and risk perception research to assess how official responses and public reactions can guide future planning.

Risk perception

Terrorism in risk perception

Risk perception provides a core component to understand why societies respond and act as they do to risks. Where the perception of risk is greater than the actual risk, individuals, according to Rogers et al (2007) tend to “overreact” to those risks that are hard to understand, involuntary, and invisible despite evidence and reassurances by experts that a particular risk is minimal or unlikely. For example, parents in the UK who refused their children to receive the mumps, measles and rubella (MMR) vaccine for fear this caused autism following a 1998 scientific study that was later discredited and found to be inaccurate (Raithatha et al, 2003). Despite subsequent scientific evidence refuting any connection, MMR immunization continued to drop, leading to a 36% increase in measles among children by 2009 (Laurance, 2006).

Risk perception studies have been developed through a theoretical framework, the risk matrix (or psychometric paradigm), to understand why people perceive hazards differently (Fischhoff et al, 1978). The risk perception research that developed the risk matrix emanated from the work of Slovic (1987), Fischhoff (1978) and Lichtenstein, first published in the 1970s and 1980s (Lofstedt and Boholm, 2009). Identifying, characterizing and quantifying risk enables one to explore how people perceive and respond to risks (risk perception). This in turn provides a basis for improving dialogue with the public (risk communication) prior to, during and after an attack (Slovic, 2000a). The risk matrix helps to explain why the public is not prone to panic during and following a terrorist attack, but can calmly undertake activities that may increase their exposure to another risk (Sheppard et al, 2006).

The risk matrix assumes that risk is subjectively defined by individuals who are influenced by a wide array of psychological, social, institutional and cultural factors. Perceived hazards and risks, as defined by the public, can be plotted on a grid with an *x* axis from non-dread to dread risks (left to right) and *y* axis from known to unknown risks (bottom to top). Non-dread risks are those perceived to be more controllable, low risk to future generations and not affecting themselves (e.g., familiar items like using home appliances). Dread risks are those seen as uncontrollable, high risk to future generations and involuntary (e.g., nuclear weapons). The *y* axis has unknown risk that is not observable, unknown to those exposed, and the effects of it are delayed (e.g., nitrates or carcinogenic compounds). Known risk is observable, old risk, and risks known to science (e.g., driving a car).

Despite the defined categories, the matrix is an approximation of a complex reality, one that varies by gender, age, experience, and recent history. Because an aggregated approach is taken, the paradigm has been critiqued for overlooking individual differences of risk perception (Siegrist et al, 2005). In the context of terrorism, studies have found that socio-demographics (Torabi, 2004), culture (Kovatz et al, 2006; Nakano, 1995), and prior experience of violence (Rubin et al, 2005) influence the degree of perceived risk of terrorism. In addition US studies have identified the “white male effect” where, as Slovic (2002) observed, white males may perceive risk less than others because of greater involvement in “creating, managing, controlling and benefitting from technology and other activities that are hazardous”. Nevertheless, the model provides some explanatory power for understanding terrorism (Sjoberg, 2005). This can help guide and contextualize societal responses, and examine how governments can mitigate the terror and adverse avoidance behavior that may ensue. Of particular value is the ability to compare the degree of perceived dread and unknown risk created by different types of terrorist attacks, and measures society can undertake to mitigate terror. Figure 1 illustrates the tug-of-war between terrorists and society each vying to influence the extent of terror generated, and the avoidance and adaptive behaviors that may ensue.

The risk of terrorism can be distinguished from other risks, such as manmade or natural disasters, by, according to Rogers (2007), “characteristic extensive fear, loss of confidence in institutions, unpredictability and pervasive experience of loss of safety”. The threat of terrorism is a particularly complex hazard for individuals and population centers to interpret and respond to because, as Paul Slovic remarks, “it comes from the intentions of other people, and those are hard to understand” (Monmaney, 2001). Unlike the study of risks of environmental pollution, nuclear power and activities like driving and diving, the hazard of terrorism by its very nature is stochastic, being difficult to determine when, where, and what type of attack may occur. Terrorism includes additional

attributes ranging from the duration of a terrorist campaign, the perceived existential threat to individuals, the type of targets chosen, and the delivery mechanism used. For these reasons, terrorism is seen more as a dread risk, but also in the known risk (leaning towards the unknown risk quadrant). In comparison, nuclear power is seen as both as dread risk and unknown risk (Slovic et al, 2000b).

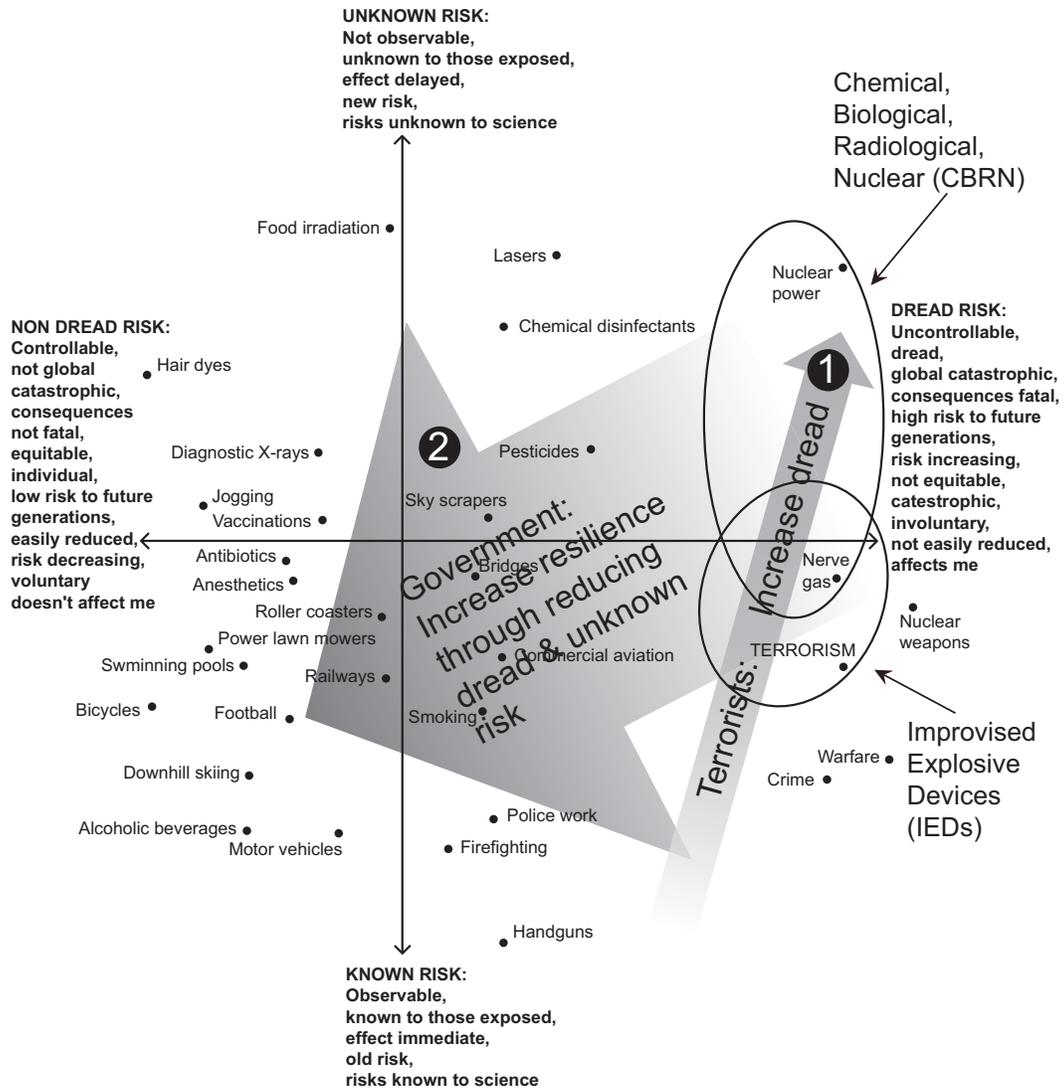
Given the uncertainty and dread surrounding terrorism, why is this risk not then located in the unknown risk quadrant? A possible explanation is that the original psychometric studies were undertaken in the US during the late 1970s when terrorism was viewed by Americans as a risk relevant to only foreign countries (e.g., the Middle East and parts of Europe), and therefore perceived more as a known rather than as an unknown risk. Although the idea of terrorism becoming more of an “unknown” risk to Americans post 9/11 may sound contradictory, the hazard of terrorism may have shifted into the dread-unknown risk quadrant as the perceived risk of terrorism on the US homeland is elevated.

Whereas the original psychometric studies treated terrorism as a single risk event, tackling terrorism in the 21st century requires breaking terrorism out into its subcomponents from improvised explosive devices (IEDs) to chemical, biological and radiological and nuclear (CBRN) devices. Research suggests IEDs and CBRN events could be plotted at different areas on the risk matrix given their varying risk characteristics. For example, research by Burns and Slovic (2007) on the impact of IEDs and biological weapons suggested the extent and diffusion of fear is greater following a biological attack like anthrax than an IED. Consequently two broad circles can be mapped on the risk matrix (see Figure 1).

Mapping IEDs and CBRN terrorism

The bottom circle encompasses IEDs covering the dread / known to unknown risk area. For example, individuals in the vicinity or region of an IED attack but outside the blast zone would soon recognize that they are unharmed and in no immediate danger. Leaving aside possible secondary devices or additional attacks in the days ahead, the perceived threat to life diminishes unlike a chemical or radiological attack whose potency can remain for hours, days, or weeks. In certain circumstances, a systemic IED or terror campaign can gradually become more of a known risk as the targeted populace gains greater perceived certainty of when and where an attack may occur and adapt appropriately. This occurred during the Second Intifada where Israelis attempted to gain a sense of predictability of when and where attacks would take place, and occasionally had to be warned not to be complacent and be more vigilant (O’Sullivan, 2004).

Figure 1: Risk perception matrix and the competing influences of terror¹



The top circle is CBRN that extends into the unknown / dread risk quadrant. Compared to IEDs, CBRN terrorism generates greater perceived uncertainty and dread, with fear subsiding at a slower rate (Burns and Slovic,

¹ Adapted from Paul Slovic, Baruch Fischhoff, and Sarah Lichtenstein, 'Facts and Fears: Understanding perceived risks' (pp 181-214) in Richard C. Schwing and Walter A. Albers, Jr (eds) *Societal risk assessment: how safe is safe enough?* Publisher: New York/ London: Plenum Press, 1980, p. 201, Figure 5

2007). Factors that influence the degree of dread and unknown risk include the type of device (C,B,R, or N), the lethality of the device, the area size and duration of contamination, the population density, the type of area (regularly frequented by the public like a business district or urban areas), and capabilities of emergency responders to decontaminate individuals and provide medical support.

Tug-of-war of terror

Since the modern era of terrorism in the mid 20th century, terrorist groups have employed increasingly indiscriminate and lethal attacks to achieve their desire for publicity, greater destruction, and erosion of self-imposed restraint (Hoffman, 2002; Wilkinson, 2001). Arrow 1 on figure 1 illustrates how terrorists can overtime pursue attacks that aim to cause greater terror and dread. The weapon of choice is largely determined by a terrorist group's capability and intent. Some groups are capable of greater destruction and terror, but choose not to, believing this would undermine their intended strategy, or judge their current approach as adequate (Laqueur, 2002). For example, Hamas and Hezbollah view conventional attacks (suicide bombings and katusha rocket attacks armed with high explosive and ball bearings) as adequate means to create the terror they seek to pursue their objective of a Palestinian homeland (Post, 2009). This is not to say they may not change their strategy in the future. Groups inspired by and affiliated with Al Qaeda who may have less self-imposed restraint could pursue CBRN devices (Hoffman, 2006).

While terrorist groups seek to cause terror, the targeted society can take measures to reduce the dread and unknown risk by building strategies to augment resilience that incorporate principles of risk perception, risk communication, and the social amplification of risk (depicted by arrow 2). The tug-of-war effect comes into play with terrorists seeking to increase the dread / unknown risk, competing with authorities aiming to reduce terror. How successful a targeted region is in countering the terror influences the degree to which it can withstand and endure attacks. For example, inadequate preparation and execution of risk communication and emergency response following a radiological attack could weaken a state's ability to mitigate the terror generated. In extreme cases, the response can exacerbate the dread risks through mismanagement and lack of trust.

Understanding how fear and dread risk is influenced by the type of attack and how authorities respond provides a basis to explore the types of behavioral reactions that may be exhibited by the public in response to terrorism events. Of particular interest are avoidance and adaptive behaviors given the consequences for the well-being of individuals and the economy (Slovic, 1987; Sheppard, 2006 & 2009; Rose, 2005). Based on case studies, the next two sections will provide an insight into the tug-of-war effect by examining 1) types of avoidance behavior

that manifested from terror; 2) measures that succeeded in mitigating adverse avoidance behavior, and 3) strategies that exacerbated the terror leading in some cases to adverse societal consequences.

Avoidance and adaptive behaviors

The changes in behaviors and attitudes following attacks can vary significantly depending on a number of factors including the type and duration of attack, the population's prior experience of terrorist events, and how authorities respond (the effectiveness of emergency response plans and risk communication strategies, for example). While respecting the variation of responses, we can look at how the possible reactions might be broadly categorized. A detailed analysis of an array of terrorism case studies suggests there are two broad ends to responses.² First, responses with neutral consequences for the well-being of individuals and those around them. Neutral effects include a reduction in the use of a recently targeted transport system, or less frequently going to locations previously attacked (e.g., shopping districts or restaurants). These pose regional economic consequences while the well-being of individuals are generally not affected.³ At the other end of the spectrum are responses that potentially have adverse consequences for the safety and health of individuals and communities. These include individuals embarking on activities that pose a greater risk to their own well-being while believing they are reducing the risk of being subjected to a terrorist attack (e.g., choosing a mode of transport or behavioral change that poses a greater risk to them).

The extent and duration of these avoidance and adaptive behaviors may vary according to the degree of perceived dread and unknown risk created by the terrorist event and subsequent handling by authorities. While public reactions could be plotted on a continuum between neutral and harmful responses, the higher the perceived dread and unknown risk (further into the top right quadrant), the more extensive and persistent the avoidance and adaptive behaviors may be. The discussion below provides examples to illustrate the type of responses that could be broadly categorized in the neutral and harmful response areas.

² A detailed assessment on the case studies can be found in Sheppard, B., *Psychology of Strategic Terrorism: Public and government responses*, (Routledge, 2009)

³ Exceptions can be mental health well-being where avoidance and adaptive behaviors can be part of probable post-traumatic stress disorder (PTSD) and associated symptoms caused by trauma individuals have experienced.

Neutral responses

Whether it be a single terrorist incident or a series of attacks as part of an ongoing terrorist campaign, the public can develop what Shalev (2005) calls, a virtual “map of fear” that keeps people in illusionary, but functional control. Often these changes do not have ramifications for the well-being of individuals or others around them. With reference to the Second Intifada, Shalev (2005) suggests fear maps reduced distress and apprehension. For instance, to avoid the perceived risk of bus bombings during the Second Intifada, a study by Kirschenbaum (2006) found that around 25% of Israelis kept away from buses when traveling in a car and traveled less often by bus, avoided peak rush hour and took taxis more often. Those who took the bus undertook precautionary behavior that included choosing a seat on an empty bus (16%), sitting near the entrance of a bus (18%), sitting near the driver (15%), or toward the back of the bus (13%). In addition the perceived security risk of the destination influenced Israelis’ behavior - 41% avoided crowded public places, 43% only went where there were security guards, and 14% traveled more by train. Many Israelis chose homebound entertainment instead of heading to entertainment areas with crowds like cinemas and other outside activities (Kirschenbaum, 2006).

A similar example is the July 2005 London bombings where in the subsequent months following the attacks and the failed attempt two weeks later, there was a 10-15% decline in passenger numbers on the London Underground on weekdays and 20-25% on weekends (BBC Today Program, 2005). In the following months, there were 30 million less journeys than expected in 2005 and by 2006 passenger numbers returned to expected levels (Webster, 2005). However, an attack that defied one’s own fear map would heighten distress and fear. For instance, some Israelis believed that attacks would not occur at locations that hosted Jews and Arabs or on Fridays because they are a day of prayer for Islam. When attacks occurred on a Friday and at a café at Hebrew University that hosted both Arabs and Jews, Israelis needed to reconstruct their fear maps (Shalev, 2005).

Although these avoidance behaviors are generally not detrimental to individuals well-being and safety, they can result in economic damage to regional and local economies. For instance, individuals visiting shopping malls and eating out less often, or businesses relocating. According to Rose (2005), the economic impact from terrorist attacks includes not just the physical destruction to property, but also a reduction in consumer and investor confidence, turmoil in financial markets, the costs of increased risk, and lost production (e.g., wages and profits).

Harmful responses

Of greater concern are behavioral changes that undermine the safety and well-being of individuals and those around them. Members of the public can amend their daily routines to avoid the perceived risk of a terrorist hazard (for instance, a previously targeted transport system), only to embark on an activity that poses a greater risk to themselves. For example, a contentious issue is whether the fear of flying among Americans post 9/11 led to an increase in the number who drove, resulting in more road fatalities. Although Gigerenzer (2006) research suggested that in the 17 months after 9/11 the number of miles Americans drove on rural interstate highways increased between 2-5% leading to an increase of 1,595 road fatalities, research by Su et al (2009) found there was a lower increase in fatalities (approximately 353 in first three months). Su's (2009) findings did not support the claim that there was notable increase and correlation in driving miles and in traffic fatalities across the US. Instead stress increased among the public in the northeast of the US due to their proximity to the attacks which led to an increase use of drug and alcohol that then impacted driving quality.

A second example is from the 2001 Anthrax attacks. Out of concern of becoming exposed to anthrax powder on letters processed at contaminated mail sorting facilities, a proportion of Americans sought a prescription to one of the antibiotics that were recommended by the Centers for Disease Control and Prevention (CDC) to treat anthrax: ciprofloxacin, doxycycline and amoxicillin. A study by Schaffer (2003) that compared the national prescription levels of these drugs during October-November 2001 to the year before showed that there was a total of 376,000 extra prescriptions. These figures do not include the 10,000 prescriptions prescribed by CDC for those suspected of being exposed to anthrax to take the 60-day treatment. While the unnecessary antibiotic use may have alleviated some psychological stress for people, the US Surgeon General warned that its unwarranted use could have led to antibiotic resistance (Blendon, 2003). Furthermore, there laid the risk of medical establishments having to treat individuals encountering adverse reactions to the medications that should not have been taken – adding pressure to public health resources.

A major concern emergency responders and public health facilities need to cope with is the potential flood of individuals who needlessly seek medical treatment after a CBR attack. This is sometimes referred to as the “worried well” or mass psychogenic illness. Pastel (2001) suggested a more neutral term of outbreaks of multiple unexplained symptoms. The 1995 sarin attack in Tokyo is often held to demonstrate the impact of large numbers unnecessarily seeking medical attention, with around three quarters of the 5,500 who sought medical care in the days following the attack not requiring urgent hospital treatment (Olson, 2009; Asukai and Maekawa, 2001). Research by Alexander et al (2003)

placed the reported ratio of those who sought medical help to those who required immediate medical care even greater at approximately 450:1.

Having identified the types of avoidance behavior that manifests from terror, the next section examines case study evidence of strategies that exacerbated avoidance and adaptive behaviors, and measures that succeeded in mitigating adverse reactions. The latter includes discussion of the importance of risk communication in the tug-of-war of terror and how this can reduce the gap between perceived and actual risks.

Social amplification of risk

The extent of avoidance behavior in response to a terrorist threat can be exacerbated or reduced by how authorities and institutions respond. While the initial scope and persistency of behavioral reactions following an attack will likely be dictated by the type of attack and its dread and unknown risk characteristics, the extent of the behavioral changes can be amplified or reduced by how the attack is handled. Delays in community intervention can lead to higher and more prolonged levels of fear (Burns and Slovic, 2007). This indirectly can assist terrorists' pursuit of terror. The social amplification of risk framework recognizing how social institutions and structures process a risk to shape its effects upon society, and the responses of management institutions and people (Kasperson and Kasperson, 1996) provides a valuable concept when applied to terrorism. The framework posits that the public's risk perceptions and ripple effects can be amplified by institutions failing to take the social context of risk into account when making decisions and conveying information to the public (Rogers et al, 2007).

Social amplification or attenuation can begin with a risk event. In the context of this paper, the risk event could be a terrorist attack, a failed attack, or a terrorism alert advisory. The perceived risk can be amplified or attenuated through nodes that include risk communicators (encompassing the government, traditional and social media, social institutions and organizations), and the effectiveness of the public health response. These elements collectively frame how a risk is ultimately perceived. Below are examples in the terrorism area.

2001 anthrax attacks

During the 2001 anthrax attacks in the US, it could be argued that the ineffective risk communication employed by public health professionals and the Federal government exacerbated the adverse reactions by the public. This included putting pressure on essential supplies of ciprofloxacin by those who unnecessarily took the antibiotic drug, an estimated 20% of whom experienced the drug's side

effects, and possibly risked changing the bacteriological environment from the widespread use of the antibiotics rendering some organisms resistant to the antibiotics employed (Shine, 2001).

The development of risk communication messages was hindered by the limited availability of epidemiological evidence and knowledge regarding the treatment and transmission of anthrax in urban environments and secondary aerolization (Hobbs et al, 2004). Published data about secondary aerolization of anthrax spores indoors was not available in late 2001 (Weis, 2002). Despite these data gaps, the mixed messages, both verbal and actions, undertaken by public health officials, politicians and the media, exacerbated these problems. CDC discovered that postal workers at contaminated sorting facilities interpreted the decision to prescribe them the less expensive doxycycline rather than ciprofloxacin as a cost-saving measure (Vanderford, 2003). It was not made clear that doxycycline had a greater efficacy against the strain of anthrax instead of ciprofloxacin that had been given to news organizations and Congressional workers in the early stages of the anthrax attacks.

Israel and the Intifadas

An example where risk communication alleviated anxiety is the Second Intifada. Following an attack, the Israeli government and the media worked together to provide up-to-date information. Within minutes, hours and days, the public was fully informed. Information included casualty rates, road access, sources of advice, and receiving hospitals. According to Shalev (2005) this was “extremely important psychologically since for most of the population the information provided signals the absence of proximal threat, and therefore constitutes a safety signal”. Hours after a bombing windows and buildings are repaired, gruesome reminders removed, and damaged trees replaced. The removal of visual evidence from an attack reduced the psychological impact and facilitated the healing of traumatized survivors by reducing their exposure to reminders of trauma (Shalev, 2005).

The extensive clean up and removal of reminders of an attack is reinforced by a survivor of a bus bombing during the First Intifada. On returning to the site of the attack at a road side café several weeks after the incident, a couple who had survived the bombing found that the kiosk had been rebuilt into a “sparkling, sleek roadside cafeteria with smiling customers going about their business, seemingly indifferent to the bombing”. The survivor noted that while they had wanted the site to reflect what had happened, they recognized that this was “the Israeli way”. She added: “They cry, mourn, and clean up the mess quickly. Life goes on, albeit in some terribly altered way. Somehow survivors brush themselves off and continue” (Yelin et al, 2005).

What should be expected from the public?

Given the array of behavioral responses identified above, what then could and should be expected from the public during or following a terrorist attack? Response measures from risk communication to first responders in the following hours, days, weeks and months after an attack need to aim where possible for the public's risk perception to be aligned with the actual risk. This is more challenging in some scenarios where there is greater uncertainty of the threat. Where perceived risk may be greater than the actual risk, this can lead to avoidance and adaptive behaviors out of proportion to the actual risk. Naturally there are incidences where the uncertainty surrounding the prospect of further attacks in the following days and weeks makes it difficult to gauge what the actual risk is and therefore identify what avoidance and adaptive behaviors are appropriate. For example, the uncertainty of whether there might be further attacks on London's transport system following the July 2005 bombings or in the US after 9/11 made it difficult to convey to the public what the risk was. Long-term recovery from CBRN events pose the challenge of communicating to the public what areas contain acceptable low levels of contamination and are safe to return.

There is no one size fits all strategy. A response strategy needs to aim for aligning the public's perceived risks with the actual risks in the short and long term to reduce adverse ripple effects. These include economic ripple effects (e.g., individuals avoiding business districts or transport systems previously targeted) and public health repercussions (e.g., individuals pursuing activities that pose a greater risk to their own well-being like needlessly acquiring ciprofloxacin). Even where there are scenarios where it is difficult to map the perceived and actual risks, identifying and addressing adverse avoidance behavior remains fundamental. Collectively this would strengthen societal resilience to better endure and recover from an attack.

Importance of risk communication

Risk communication is an integral element in the tug-of-war of terror in shaping how people will evacuate, respond, seek medical treatment or change their daily lives to mitigate the threat of terrorism. Risk communication is critical in developing an effective response to better align perceived with actual risks (Fischhoff, 2006) to mitigate avoidance behavior and elicit desired behavioral responses. This entails maintaining the credibility of communications and ensuring the public has trust in those delivering the messages. Lack of trust can cause individuals to view certain risks as greater than they are or to lose confidence in those leading and developing policy (Rogers, 2007).

Risk communication should be a two-way interchange between source organizations and those, including the public and its representatives, who are the intended recipients of risk messages (NRC, 1989). Effective risk communication first requires understanding what individuals believe in order to encourage them to adopt a new set of behaviors (Fischhoff, 2002). Fischhoff (2006) defined risk communication as “creating two way channels, in which recipients are treated like partners, shaping how risks are managed and sharing what is learned about them”. Risk communication research has been used in various areas covering natural and technological hazards including food safety, regulation, environmental policy and nuclear power (Fischhoff, 1995). Fischhoff (2006) outlines three principles for effective risk communication in the context of terrorism.

- First, manage risk well - so as to have a credible message to communicate.
- Second, create appropriate communication channels to increase public confidence by demonstrating that a common framework underlies preparation, alert, crisis, and recovery plans.
- Third, deliver decision-relevant information, concisely and comprehensibly through studying what the public already knows, and then designing (and evaluating) the communications to bridge critical gaps.

The manner in which risks are presented can either decrease or increase the levels of perceived risk and subsequently influence avoidance and adaptive behaviors (Keller et al., 2003). Tools which risk communication researchers can deploy to mitigate dread risk and elicit desired behavioral responses include, first, the “affect heuristic” to guide perceptions of risk and benefit. Communicating the benefits of an activity can change the perception of risk and vice versa (Slovic, 2004). Second, exploring how anger inducing messages could reduce dread risk perceptions and negative risk estimates (Turner, in press; Lerner, 2003).

The challenge is how a risk communication strategy can be developed to prepare the public for unpredictable and largely unknowable events that appear in the upper right hand of the risk matrix quadrant. As part of issuing terrorism alerts and advising the public to be vigilant, authorities should consider communicating that were a major terrorist attack to occur, there may be ambiguity in the advice provided in the first few hours and even days after an attack. This would particularly apply to CBR events where the nature and lethality of the device may initially be unknown. Communicators should ensure the changing information and advice is not interpreted as authorities mishandling the situation. Within the first hour of an attack authorities need to provide information to the public on what they believe may be the cause and the appropriate action to take. After a severe attack like a CBR device, medical facilities may not be able to cope with the demand (either because of partial or complete closure due to contamination or

being overwhelmed by patients). Consequently, the public needs to be aware that they may be advised to conduct self-triage to determine if they have been exposed to a contaminant to establish whether they should seek medical care. This aspect is essential to building initial trust and effective engagement with the public.

Conclusion

The risk perception matrix provides a valuable means to contextualize and evaluate the societal effects of different types of terrorist events, and how response measures can alleviate and reduce the terror of terrorism. In particular, how the perception of terrorism may translate into avoidance and adaptive behaviors (neutral and harmful responses), and what measures can be undertaken to reduce the ripple effects that can be detrimental to individuals well-being, and pose economic repercussions. Collectively this can then enhance the resiliency of a society by being better prepared by having effective strategies to mitigate the terror of terrorism. Although the risk matrix has its limitations by taking an aggregated approach, the framework can guide preparedness to an array of terrorist attacks.

References

- Alexander, D.A.; Klein, S. "Biochemical terrorism: too awful to contemplate, too serious to ignore." *British Journal of Psychiatry*. 2003; 183: 491-497.
- Asukai, N.; Maekawa K. "Psychological and Physical Health Effects of the 1995 Sarin Attack in the Tokyo Subway System."- In: Havenaar, J.; J. Cwikel, editors. *Toxic Turmoil: Psychological and Societal Consequences of Ecological Disasters*. (New York, NY: Kluwer Publishers, 2001): 149-162.
- Blendon, R.J. "Using Opinion Surveys to Track the Public's Response to a Bioterrorist Attack." *Journal of Risk Communication*, 2003; 8: 83-92.
- Burns, W.J.; P. Slovic. "The Diffusion of Fear: Modeling Community Response to a Terrorist Strike." *Journal of Defense Modeling and Simulation: Applications, Methodology, Technology*, 2007; 5(4): 1-20.
- Fischhoff, B.; P. Slovic; S. Lichtenstein; S. Read; B. Combs. "How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits." *Policy Sciences*, 1978; 9(2): 127-152.

- Fischhoff, B. "Risk Perception and Communication Unplugged: Twenty Years of Process." *Risk Analysis*, 1995, 15(2): 137-145.
- Fischhoff, B. "Assessing and Communicating the Risks of Terrorism," In: Teich A.; S. Nelson; S. Lita and A. Hunt, editor. *Science and technology in a vulnerable world*: (Washington, DC, AAAS, 2002).
- Fischhoff, B. "Psychological Perception of Risk." In: Kamien D, editor. *The McGraw-Hill Homeland Security Handbook*. (New York: McGraw Hill, 2006): 463-492.
- Freedman, L. "Strategic Terror and Amateur Psychology," *The Political Quarterly*, 2005; 76(2): 161-170.
- Gigerenzer, G. "Out of the Frying Pan into the Fire: Behavioral Reactions to Terrorist Attacks," *Risk Analysis*, 2006; 26(2): 347-351.
- Hoffman, B. "Rethinking Terrorism and Counter Terrorism Since 9/11," *Studies in Conflict and Terrorism*, 2002; 25(5): 303-316.
- Hoffman, B. *Inside Terrorism*, (New York: Columbia University Press, 2006).
- Hobbs, J.; A. Kittler; S. Fox; B. Middleton. "Communicating Health Information to an Alarmed Public Facing a Threat Such as a Bioterrorist Attack," *Journal of Health Communications*, 2004; 9: 67-65.
- HSI. *Resilience – Concept Development: An Operational Framework for Resilience*. Homeland Security Institute. August 27, 2009.
- Kasperson, R.E.; J.X. Kasperson. "The Social Amplification and Attenuation of Risk." In: Hunreuther, H; P. Slovic. Editors. "Challenges in Risk Assessment and Risk Management." *The Annals of the American Academy*, 1996; 545(1): 95-105.
- Keller, C.; M. Siegrist; H. Gutscher. "The Role of Affect and Availability Heuristics in Risk Communication." *Risk Analysis*, 2003; 26(3): 631-639.
- Kirschenbaum, A. "Terror, Adaptation and Preparedness: A Trilogy for Survival." *Journal of Homeland Security and Emergency Management*, 2006; 3(1): 1-33.

- Kovatz, S.; I. Kutz; G. Rubin et al, "Comparing the distress of American and Israeli medical students studying in Israel during a period of terror." *Medical Education*, 2006; 40(4): 389-393.
- Laqueur, W. *The New Terrorism: Fanaticism and the arms of mass destruction*, (London: Oxford University Press, 2002).
- Laurance, J. "MMR row blamed for measles outbreak", *Independent*, 6 February, 2006: 13.
- Lerner, J.S.; R.M. Gonzalez; D.A. Small; B. Fischhoff. "Effects of fear and anger on Perceived Risks of Terrorism." *Psychological Science*, 2003; 14: 144-150.
- Lofstedt, R.; A Boholm. "The Study of Risk in the 21st Century," In: Lofstedt, R.; A. Boholm. *Risk*, (London: Earthscan, 2009): 1-23
- Mileti, D. *Disasters by Design: A Reassessment of Natural Hazards in the United States*, (Washington, DC: Joseph Henry Press, 1999).
- Monmaney, T. "Response to Terror: The Psychological Toll", *Los Angeles Times*, September 19, 2001, A1.
- Morgan, M. G.; B. Fischhoff; A. Bostrom; Atman C J. *Risk Communication: A Mental Models Approach*, (West Nyack, NY, USA: Cambridge University Press, 2001).
- Nakano, K. "The Tokyo Sarin Gas Attack: Victims Isolation and Post-Traumatic Stress Disorders," *Cross-Cultural Psychology Bulletin*, December 1995; 29: 12-15.
- National Research Council (NRC), *Improving Risk Communication, National Research Committee on Risk Perceptions and Communication*, (Washington, DC: National Academies Press, 1989).
- National Research Council (NRC), *Review of the Department of Homeland Security's Approach to Risk Analysis*. (Washington, DC: National Academies Press, 2010).

- Norris, F.H.; S.P. Stevens; B. Pfefferbaum; K.F. Wyche; R.L. Pferrerbaum. "Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness." *American Journal Community Psychology*, 2008; 41: 127-150.
- Norris, F.; M. Tracy; S. Galea. "Looking for Resilience: Understanding the Longitudinal Trajectories of Responses to Stress." *Social Science and Medicine*, 2009; 68: 2190-2198.
- Olson, K.B. "Aum Shinrikyo: Once and Future Threat?" *Emerging Infectious Diseases*, 1999; 5(4): July-August: 513-516.
- O'Sullivan, A. "Anti-terror advisor: Israelis too complacent about security." *Jerusalem Post*, 8 April, 2004.
- Pastel, R.H. "Collective Behaviors: Mass Panic and Outbreaks of Multiple Unexplained Symptoms," *Military Medicine*, 2001; 166(12): 44-46.
- Pidgeon, N. et al. *Risk Analysis, Perception and Management: Report of a Royal Society Study Group*. (London: Royal Society, 1992).
- Post, J. *In the Mind of the Terrorist*. (New York: Palgrave Macmillan, 2009).
- Raithatha, N., et al, "A Qualitative Investigation of Vaccine Risk Perception Amongst Parents Who Immunize Their Children," *Journal of Public Health*, 2003; 25(2): 161-164.
- Rogers, B; R. Amlot; G. J. Rubin; S. Wessely; K. Krieger. "Mediating the Social and Psychological Impacts of Terrorist Attacks: The Role Of Risk Perception and Risk Communication." *International Review of Psychiatry*, 2007; 19(3): 279-288.
- Rose, A. "Analyzing Terrorist Threats to the Economy: A Computable General Equilibrium Approach." In: Richardson, H; P. Gordon and J. Moore, editors. *Economic Impacts of Terrorist Attacks*. (Cheltenham, UK: Edward Elgar Publishing Company, 2005), p. 196-217.
- Schaffer, D. et al. "Increased US Prescription Trends Associated with the CDC Bacillus anthracis Antimicrobial Post Exposure Prophylaxis Campaign," *Pharmacoepidemiology*, 2003; 12(3): 177-182.

- Shalev, A.Y. "The Israel Experience," In: Lôpez-Ibor, J.J.; G. Christodoulou et al. *Disasters and Mental Health*. (London: Wiley, 2005): 217-228.
- Schoch Spana, M. "Educating, Informing and Mobilizing the Public," In: Levy, B; V. Sidel. *Terrorism and Public Health: A balanced approach to strengthening systems*, (Oxford University Press, New York, 2003): 118-135.
- Shine, K. "Hearing on Risk Communication: National Security and Public Health" (testimony presented to the Subcommittee on National Security, Veterans Affairs, and International Relations). House Committee on Government Reform. Washington, D.C.: 29 November, 2001.
- Sheppard, B.; G.J. Rubin; J.K. Wardman; S.Wessely. "Terrorism and dispelling the Myth of a Panic Prone Public." *Journal of Public Health Policy*, 2006; 27(3): 219-9.
- Sheppard, B. *Psychology of Strategic Terrorism: Public and Government Responses*, (Routledge, 2009).
- Siegrist M.; C. Keller; H.A. Kiers. "New Look at the Psychometric Paradigm of Perception of Hazards." *Risk Analysis*, 2005; 25(1): 211-222.
- Slovic, P. "Perception of Risk." *Science*, 1987; 236: 280-285.
- Slovic, P(a). "Perceptions of Risk," In: Slovic, P. (editor). *The Perception of Risk*, (London: Earthscan Publications Ltd, 2000): 220-231.
- Slovic, P(b); B. Fischhoff; S. Lichtenstein. "Facts and Fears: Understanding Perceived Risk." In: Slovic, P. (editor). *The Perception of Risk*, (London: Earthscan Publications Ltd, 2000): 137-153
- Slovic, P. "Terrorism as Hazard: A New Species of Trouble." *Risk Analysis*, 2002; 22(3): 425-426.
- Slovic P.; ML Finucane, E Peters, DG MacGregor. "Risk as Analysis and Risk as Feelings: Some Thoughts about Affect, Reason, Risk, and Rationality." *Risk Analysis*, 2004; 24(2): 311-322.
- Sjoberg, L. "The Perceived Risk of Terrorism," *Risk Management: An International Journal*, 2005, 7(1): 43-61.

Su, J., et al., "Driving Under the Influence (of Stress)." *Psychological Science*, 2009; 20(1): 59-65.

Today Programme. BBC Radio 4. August 4, 2005.

Torabi, M.R.; D.C. Seo. "National Study of Behavioral and Life Changes Since September 11." *Health Education Behavior*, 2004; 31: 179-192.

Turner, M.T.; E. Bessarabova; S.M. Sipek. "The Interaction Effect of Anger Intensity and Efficacy on Message Processing and Behavioral Intentions: A Test of the Anger Activism Model," In Press 2011.

Vanderford, M.L. "Communication Lessons Learned in the Emergency Operations Center During CDC's Anthrax Response: A Commentary," *Journal of Health Communications*, 2003, June: 11-12.

Webster, B. "Passengers Conquer Fears and Get Back on the Tube." *London Times*, July 7, 2006, p.8

Weis, C.P.; A.J. Intrepido; A.K. Miller; P.G. Cowin; M.A. Durno; J.S. Gebhardt; R. Bull. "Secondary Aerosolization of Viable Bacillus anthracis Spores in a Contaminated US Senate Office." *Journal of American Medical Association*, 2002; 288(22): 2853-2858.

Wilkinson, P. *Terrorism versus Democracy: The Liberal State*, (London: Frank Cass Publishers, 2001).

Yellin, D. "Voice: Ten Years Later?", In: Danieli, Y et al., *The Trauma of Terrorism*, (London: Taylor and Francis, 2005).