

## **PART I**

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### **INTRODUCTION: THE KNOWN AND THE UNKNOWN**

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# 1

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## PREPAREDNESS, UNCERTAINTY, AND TERROR MEDICINE

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*As mentioned in the Prologue, the chapters in this volume generally begin with a case study of a terrorist or disaster event. This narrative format introduces the main theme of the chapter as related to local preparedness.*

*In this chapter, the case study derives from attacks on July 7, 2005, when suicide terrorists bombed three London underground trains and one bus. The narrative here focuses on the bus bombing. Despite individual acts of heroism by responders and bystanders, organized response efforts were often wanting.*

*The lessons of 7/7, as the day is called, can be helpful in preparing for terrorist attacks in communities everywhere. Some of the experiences that day were unanticipated because they had seemed improbable. A range of uncertainties may apply as well to other events, whether they arise from deliberate, accidental, or natural causes. Among the lessons of 7/7 that apply to all such incidents is the importance of anticipating the unexpected.*

### THE BOMBING OF BUS NUMBER 30

Box-shaped stone homes grace the volcanic peaks of Santorini, an island 200 miles south of Greece. Amid the island's residences, blue-domed churches match the azure of the Aegean Sea a thousand feet below. Thought by some to be the ancient city of Atlantis, Santorini has long been a favorite of romantics.

Days after returning to London from a Santorini holiday, 28-year-old Sam and his fiancé Mandy still felt the island's glow. High on Sam's to-do list was a visit to Tiffany's to buy the promised ring for the woman he adored. Meanwhile, by Thursday morning, July 7, he had resumed his daily routine.<sup>1</sup>

Headed to the Central London office where he was a software specialist, Sam had settled into a window seat on the upper deck of the Number 30 (Figure 1.1). As the bus traveled

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**FIGURE 1.1** Bus No. 30 on normal route to Central London. (Credit: Oxyman, Creative Commons Attribution 2.5 Generic License.) (For a color version of this figure, see the color plate section.)

east along Euston Road, it passed University College Hospital. An imposing structure of glass and steel, the hospital houses the largest critical care unit in Britain's National Health Service.

A block farther, beyond the red brick Quaker Friends House, traffic had become uncommonly dense. Diverted from its usual route on Euston, the Number 30 turned right and inched toward Tavistock Square. More commuters than usual were using buses and cars because train service had been suspended. The airwaves were carrying notice of a disruption to the city's underground rail system. It was approaching 9:45 A.M. and neither Sam nor his fellow passengers fully understood the cause of the congestion.

In fact, about an hour earlier, at 8:50 A.M., nearly simultaneous explosions had blown up trains in the London underground. As injured victims began to emerge from train stations, authorities suspected that a power surge had caused explosions at six stations. Only hours later, was it realized that three trains had been bombed.<sup>2</sup> The explosions had occurred deep in the tubes where the trains were en route between stations. Smoke and debris engulfed the passengers. Some lay dead, and others trapped. Many struggled to escape by foot along the tunnel tracks in either direction.

Four suicide terrorists, their backpacks laden with explosives, had planned simultaneous detonations on different train lines. One of them, Hassib Hussein, 18, found that service on the Northern Line train, his intended target, had been suspended. Unsure of his next step, he wandered for an hour. Upon reaching Euston Road, he boarded Bus Number 30 and moved toward the rear. He stopped directly beneath the seat occupied by Sam on the deck above.

Sam Ly and Mandy Ha had left Melbourne in 2003 for a 2-year working holiday in London. But home was still Australia. They had grown up there and planned to return soon for their wedding. Although they were part of Melbourne's Vietnamese community, their circle of friends extended far beyond. Sam, a graduate of Monash University, had worked

in the school's Information Technology department. His reputation for patient assistance to computer-stumped students was legendary.

Sam's mother died of cancer when he was five, after which his father, Hi Ly, raised him alone. Father and son were still close. As Sam was riding to work, the picturesque card that he had sent from Santorini arrived in Hi Ly's mail, 10,000 miles away.<sup>3</sup>

Two long blocks south of Euston Road, Sam's bus reached the edge of Tavistock Square. To the right lay a small park whose centerpiece is a statue of Mahatma Ghandi sitting cross-legged in peaceful repose. To the left, set back from the curb, was the gated courtyard of BMA House, headquarters of the British Medical Association. BMA House stands on the site that once was home to Charles Dickens. It was there, in 1859, that he penned *A Tale of Two Cities*. "It was the best of times, it was the worst of times."

A mile and a half south, towering above Parliament, the hands of Big Ben glided to 9:47. The medical association's General Practitioners Committee was about to begin a meeting on BMA House's third floor. The half-dozen physicians in attendance heard a large bang. The room vibrated. Dr. Michelle Drage felt a heavy thud as a colleague jumped into her arms and drove them both to the floor.<sup>4</sup> According to Dr. Peter Holden, everything went "salmon pink."<sup>5</sup> (Drage and Holden recalled their experiences during hearings in 2011, part of the Coroner's Inquests into the events of 7/7. The hearings were presided over by Lady Justice Heather Hallett, a judge of the English Court of Appeal.<sup>6</sup>)

In the bus outside, Hassib Hussein had detonated his backpack of acetone peroxide. The blast blew the roof off, crushed passengers, catapulted some to the road, and propelled severed arms and legs in every direction (Figure 1.2). All that could be seen from the third floor window of the BMA House was a fog of smoke. Doctors on lower floors went into the street but those at the meeting remained in the room. They deferred to Holden who had received training in prehospital emergency management. He worried about the possibility of additional explosions and advised that they not rush to the scene.



**FIGURE 1.2** Bus No. 30 at Tavistock Square, London, after bombing on July 7, 2005. (Credit: Peter Macdiarmid/PA Wire URN:11139466. North American use only.) (For a color version of this figure, see the color plate section.)

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### Initial Response Efforts

During the next 15 minutes, the doctors in the street along with bystanders tried to remove the victims from the bus. Several passengers were dead and a few, barely alive, remained entrapped by twisted metal. But most of the casualties were carried off on makeshift stretchers, mainly tabletops (separated from the legs) obtained from the BMA House. They were placed on the courtyard ground or inside the building. When the doctors from the third floor went down to the street, patients were already spread across the courtyard. One of those physicians, James Dunn, described the situation as “fairly chaotic.”<sup>7</sup> Dunn had reached the scene with Holden, who began to assume the role of incident medical commander.

Even with an abundance of doctors tending to the casualties, they could do little without equipment. No one even had a stethoscope and tablecloths were being used as bandages.<sup>8</sup> Michelle Drage recalled that for the most part, all they could do was offer reassurance to the victims.<sup>9</sup>

Dunn noticed that someone had obtained a bag of fluid, apparently saline solution, and was trying to insert a drip into an Asian young man lying in the courtyard. The man had a gaping right shoulder wound. Dunn went over to help and then stayed with him. As Dunn recalls, “He was fairly quiet all the way through the time I was looking after him and, at one stage, he shouted quite loudly, ‘I just want to go to Australia.’ After that, his level of consciousness did seem to decrease.”<sup>10</sup>

Dunn worried that the man might be suffering from a brain injury or other internal damage. He conferred with Holden and both recognized that the patient was in urgent need of hospitalization. They agreed that he would be dispatched with the first ambulance to arrive. Meanwhile, it began to rain and the courtyard patients were carried on tabletops into the BMA building. Dunn remained inside with his patient whose name he eventually learned was Sam Ly. When an ambulance finally arrived, shortly before 11 A.M., Dunn had been waiting with Sam for an hour. At that point Euston Road had been cleared of nonessential traffic. The ride to University College Hospital, a few blocks away, took perhaps 3 minutes.<sup>11</sup>

By the time Sam was removed from the scene, 12 people had already died there. Seven died instantly from the force of the explosion, three in the next several minutes, and two later while lying in the courtyard. More than 100 other victims of the bus attack, some severely injured, continued to await removal.<sup>12</sup> Another hour and a half elapsed before enough ambulances had showed up to complete the evacuation. Thus, the bus site was finally cleared of victims 2½ hours after the blast, and 3½ hours after the first train was bombed.

### Delays and Missteps

Might those whose conditions worsened during the delay, including the two who died in the courtyard, have benefited from rapid hospitalization? Colonel Peter Mahoney, a physician with the British Army, had led a team of experts to review information about some of the train and bus victims. Their sample included 18 who never made it to the hospital. (Sam Ly was not in the sample.) They concluded that 15 of them had suffered injuries that were “nonsurvivable.” For the other three, the evidence was insufficient to reach a conclusion.<sup>13</sup>

Mahoney testified at the Coroner’s Inquests in February 2011. Four months later, in her final report, Lady Justice Hallett, the presiding coroner, offered an opinion that reached beyond the evidence provided by Mahoney or anyone else. She determined “on the balance

of probabilities that each of [the 52 mortally wounded victims from all the attacks] would have died whatever time the emergency services had reached and rescued them.”<sup>14</sup>

Her presumption of “probabilities” appears subjective. One cannot know that rapid hospitalization would have made little difference for any of the victims. A hospital’s range of diagnostic and therapeutic capabilities is manifold. It includes x-ray, MRI, and other imaging devices, drugs, oxygen, ventilators, specialists, operating facilities, all of which could only have been helpful. These features were unavailable to victims who, in some cases, waited hours before hospitalization. The “golden hour” is a tenet of emergency medicine. It refers not literally to 1 hour, but to the small window of time after injury when, for some patients, intervention can mean the difference between life and death.<sup>15</sup>

Actually, the ambulance that carried Sam had not been the first at the Tavistock location. About 10 minutes after the explosion, another one had completed a routine stop at the University College Hospital. Upon leaving the hospital and turning onto Euston Road, the driver and her fellow-paramedic noticed the commotion ahead. After taking some detours they reached the demolished bus. They parked close by and joined in moving victims to the courtyard. Then they unloaded their equipment, such as it was—a ventilation bag, collars for spinal injury, a few bags of saline fluid. Later, fearing that another explosive device might be on the bus, police blocked their return to the ambulance. The ambulance’s paramedics then stayed to assist with patients on the ground.

The London Ambulance Service (LAS) is staffed by 5000 emergency medical and other support workers. Part of the National Health Service, its ambulances are distributed among 70 stations throughout the city. All requests from the public are directed to an Emergency Operations Center where a dispatcher checks the availability of ambulances near the persons in need.<sup>16</sup>

An ambulance might be sent to provide emergency aid and, if needed, transportation to a hospital. The designated hospital is commonly the closest one, or farther away if a trauma center or other special services seem necessary. If many casualties are involved, dispatchers must avoid overloading any single hospital with too many patients.

At 9:48 A.M., 1 minute after the explosion, the LAS received the first of several calls that a bus had blown up in Tavistock Square. Many people were screaming, said one caller. At least 10 were hurt, reported another. Yet as barrister Caoilfhionn Gallagher noted at subsequent hearings on the bombings, the warnings “were not acted upon.”<sup>17</sup>

Terry Williamson, an operations manager with the ambulance service, testified that he and two crew members at the LAS headquarters on Waterloo Road were deployed to a supposed incident at the Liverpool Street tube station. Upon arrival they found the station empty and that no explosion had occurred there. Concluding that “there was no need for us to be there,” they returned to headquarters and were tasked to Tavistock Square. Slowed by heavy traffic, the mile-plus drive from Waterloo took them 10 minutes. They had heard that an explosion had taken place at Tavistock but knew nothing more. No one told them that a bus was involved or that people were injured. This they learned when they arrived at Tavistock Square at 10:50, more than 1 hour after the blast there.<sup>18</sup>

### Communications Failures

The crowd was thick outside the cordoned area and moving about was difficult. Worse, the radios worked sporadically or not at all. “We were unable to have communications with anyone,” Williamson lamented—either at the scene or at central ambulance control. As a consequence, he underestimated the number of seriously wounded patients at Tavistock.



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After 11 A.M., he spotted four newly arrived ambulances, but redirected three of them away. He thought the need was greater at a train station a few blocks south. Only at 11:20, a half hour after he had arrived at the Tavistock site, did Williamson learn that anyone had died there.<sup>19</sup>

Testimony from Dr. Tim Harris further underscored the devastating effects of inability to communicate. An emergency medicine physician, Harris worked at the Royal London Hospital. The Royal London is among six major hospitals within a half-mile of Tavistock Square. A leading trauma center, it is the base for the Helicopter Emergency Medical Service (HEMS) in which Harris also served. Several teams had already been sent to train stations when, shortly after 10 A.M., Harris learned about the Tavistock explosion. The HEMS's single helicopter and five rapid response cars are positioned to provide supplies and services by air or land. Their crews are trained to institute medical management when they arrive at any scene that contains a number of casualties.

Since Tavistock was nearby, Harris, with another physician and a paramedic, went there by car. They arrived with splints and other materials at 10:20, at which time Harris met Peter Holden. Harris was satisfied that Holden was overseeing medical care as well as possible under the circumstances. But he still lacked information about the availability of resources and the activities of other personnel. He tried to find the site commanders of other responder groups including police, fire, and ambulance services. He was unable to locate any of them face to face, by radio, or by phone.

Some responders had stopped using mobile phones out of fear that they could set off a secondary explosive. But whether for that reason or because phones had broken or the system was overloaded, every effort at distance communication had failed. Radios, mobile phones, the landline in the BMA House no longer functioned. Reliving his frustration, Harris recalled that "I was unable to access communications either to my parent hospital, to the coordinating desk of London HEMS, or to [command control] at the London Ambulance Service."<sup>20</sup>

Later at the coroner's hearing, toward the end of Terry Williamson's testimony, he was asked a summary question: "This entire episode . . . at Tavistock Square was bedeviled by failures of communications. Would that be fair?" To which he replied, "Yes," and emphatically, again, "Yes."<sup>21</sup>

In fact, communications and organizational mishaps had plagued response efforts not only at the bus site but throughout the city. Many individuals acted selflessly that day, but they were hampered by faulty information, confused directives, and poor coordination. The lapses were especially ironic at Tavistock Square, where a multitude of doctors was available within seconds of the blast, and hospitals were potentially reachable within minutes.

Before the day was over, Sam Ly had fallen into a coma and word of his condition eventually reached Australia. Hi Ly boarded a plane to be at his son's bedside while friends and family in Melbourne awaited updates on Sam's status. A friend from college, William Luu, posted a note on his Web site, *Will's Blog*: "I just don't know what to say or write right now. It's incredibly sad. I think the most I can do is just pray that he'll get through it okay."<sup>22</sup>

In the following days, dozens of friends offered comments and prayers on *Will's Blog*. The messages ranged from confident: "I remember he is a strong and bubbly character so I am sure he will wake up and come back to Melbourne"—to resigned: "I consider Sam one of the best friends a guy can have and I am saddened and shocked about what happened in London."



During the week, Sam was transferred to the National Hospital for Neurology and Neurosurgery, another of the hospitals within a half-mile of Tavistock Square. He died there on July 14, becoming the 13th fatality of the bus bombing and the 52nd of all the 7/7 victim fatalities. More than 700 others had been injured by the four bombings. Sam's fiancé and his father accompanied his body back to Australia. Before the burial, 100 members of Melbourne's Vietnamese community held a prayer vigil in celebration of his life.

### What Went Wrong

On the eve of the London bombings, the United Kingdom would have seemed unusually well positioned to respond to a terror attack. The country's history of bombings by the Irish Republican Army (IRA) provided years of experience in dealing with terrorist assaults. Its medical, police, fire, and other responder personnel were highly skilled and sensitive to the threat.

The location of the bus explosion was especially fortuitous. Other than at a hospital entrance, it is hard to imagine a location better suited to help victims than at the front of a medical association headquarters. On 7/7, numerous doctors, though without equipment, were immediately available. Yet as later became evident, response efforts at that site were as wanting as at the underground train bombings. A sample of findings reveals a stunning assortment of deficiencies throughout the response network:

- Only half of the 201 London ambulances available in the area on July 7, 2005, were sent to the attack scenes.<sup>23</sup>
- Ambulance crews who were stationed near the attack sites were held back in case there were more assaults. Some of the crews were watching the events unfold on television.<sup>24</sup>
- Ambulance service headquarters was chaotic, with emergency phone calls going unanswered, key personnel unable to log on to computers, and emergency vehicle ignition keys lost.<sup>25</sup>
- At the ambulance control center, only one woman was tasked with logging all the emergency information as it was given to her on scraps of paper. She was in charge of updating the control room white board but could only reach half way up the board.<sup>26</sup>
- Eventually, there was so much information coming in to the control center that the staff there could not prioritize it effectively.<sup>27</sup>
- Firemen did not enter train tunnels because of their own safety rules even as injured passengers were walking through the tunnels toward exits.<sup>28</sup>
- Police officers discovered that their radios did not function underground.<sup>29</sup>
- Because of confusion and poor communications, fire and ambulance teams sometimes stood by while victims lay dying amid the train and bus wreckage.<sup>30</sup>
- Distribution of patients to some hospitals was hugely imbalanced. For example, some 200 patients were sent to the Royal London Hospital while Homerton, Newham, and Central Middlesex hospitals, which were all on standby, received none.<sup>31</sup>

A month after the bombings, officials of the London Ambulance Service authored an assessment titled, "Bombs Under London: The EMS Response Plan That Worked." The article displayed a self-congratulatory attitude that was common in the response community

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at that point. The authors' conclusion: "A tried and tested plan, well-trained crews and staff, and the availability of equipment on vehicles around London meant that London Ambulance Service was able to respond efficiently to these horrific events and maintain appropriate service levels to the rest of the city."<sup>32</sup>

As later became clear, the authors ignored or were unaware of numerous missteps. Some of these were acknowledged in a review ordered by the London Assembly, the city's oversight body of elected representatives. The assembly's July 7 Review Committee issued its report in June 2006. The "overarching, fundamental lesson," according to the report, was that procedures "tend[ed] to focus too much on incidents, rather than on individuals, and on processes rather than people."<sup>33</sup>

The document offered 54 recommendations. Some, such as calls to enhance communications among the responders and provide accurate information to the public, were obvious.<sup>34</sup> Other recommendations, while aiming to be helpful, seemed small bore. Among them, that first aid kits be placed on trains and in stations, that torches be available in case emergency lighting fails, that survivors be better informed about support services.<sup>35</sup>

A year later, the Review Committee issued a follow-up report indicating that several of its recommendations had been adopted, though for others, "more work is needed."<sup>36</sup> The Review Committee in 2006–2007 and the Coroner's Inquests in 2010–2011 provided a forum for hundreds of witnesses. Their testimonies led to a fuller understanding of the events of 7/7, and London has become better prepared as a result. But neither of the inquiries addressed a systemic weakness in London's preparedness, one that has been evident elsewhere as well. It derives from a rigidity of attitudes based on pre-event assumptions.

## THE KNOWN, THE UNKNOWN, AND THE BLACK SWAN

Preparedness for terror and disaster logically takes into account past experience. But readiness for the known is, or should be, the easy part of the process. Preparing for the unknown is the greater challenge. In old Europe, people believed that all swans were white. They had never seen a black swan and assumed that none existed. In sixteenth century England, the term "black swan" was a common expression to signify that something was impossible. Only after the discovery of Australia and the sighting of actual black swans, was this age-old assumption abruptly ended. Nassim Nicholas Taleb employs the swan symbolism to describe effects of the highly improbable.<sup>37</sup>

Prior to September 11, 2001, the deliberate crashing of hijacked jetliners into buildings had never occurred in the United States or elsewhere. The seeming improbability of that scenario contributed to inadequate preparedness for its eventuality. Similarly, past experience with tsunamis prompted Japan to build 25-foot high coastal walls of protection. Then in March 2011, an earthquake unleashed a 30-foot wave that poured over the barriers and devastated the coastal lands. As with the 9/11 attacks, the Japanese assumption based on the previously known was upended by a *black swan*.

In the case of 7/7, response efforts were complicated by two deviations from the known. The first was the launching of nearly simultaneous attacks at different locations. The second was the nature of those locations. Before ending its armed campaign against the British in 2005, the IRA had launched hundreds of terrorist assaults. Almost all involved the detonation of a bomb at a single location. Each bombing was a discrete event. The biggest exception was on "Bloody Friday," July 21, 1972, when in an 80-minute period the IRA set off 22 bombs in Belfast. The explosions killed 9 people and injured 130.

As the years passed, Bloody Friday became a distant memory. Andrew Barr, a manager for the London Underground, recalled that during the 20 years prior to 2005, local responders had never drilled for “a multitude of attacks.” Their exercises were limited to simulating an attack at one place.<sup>38</sup> The repeated single-bomb pattern primed British expectations and framed the country’s approach to preparedness.

The second deviation involved the locations of the detonations. A few of the IRA assaults had been at underground train stations, though none on a train in transit. Thus, responders were more disposed to anticipate an explosion in a station than one deep in a tunnel between stations. When the improbable happened on 7/7, the authorities were confused. Hours passed before the conflicting reports were untangled. Contrary to the initial presumptions, survivors emerging from six stations were escaping from the aftermath of three explosions, and not six.

Other misconceptions persisted into the evening. Responders at the Tavistock Square bus bombing were quickly aware that at least seven victims had died immediately after the blast and that more died soon after. Yet an 8 P.M. BBC broadcast, 10 hours after the attack, reported a police affirmation that only two people had died there.<sup>39</sup>

The simultaneity and locations of the bombings were not responsible for every complication that day. But they contributed to key lapses, including communications failures. The net effect was prolonged uncertainty about where and how many explosions had occurred, how many casualties had resulted, and which locations needed priority attention.

After the attacks, perspectives about their likelihood sharply changed. The 7/7 scenario migrated from the realm of the improbable to that of the known. Since similar events were now deemed more likely, explicit efforts were implemented to prevent them. In fact, “preparing for the last event” is not unusual.

The phenomenon was patently demonstrated in recent experiences. Ever since Richard Reid tried in 2001 to ignite an explosive in his shoe during a flight, US air passengers have had to remove their shoes for inspection before boarding. Umar Abdul Mutallab’s attempt in 2009 to detonate material hidden in his underwear subsequently led to more intrusive preboarding inspections of sensitive body areas.

But preparedness based only on past experience can give a false sense of security. Human ingenuity as well as natural forces have a way of circumventing the seemingly impregnable. A classic example was France’s construction of the Maginot line along the German border in the early 1930s. Based on their experience with German troops in World War I, the French considered the fortification along its eastern front to be impassable. But in 1940, German ground forces simply flanked it by first moving through Belgium in the north and then pouring south into France.

Overconfidence about presumed preparedness is common as well with naturally occurring disasters. Severity of destruction is often unanticipated, as was the case with Hurricane Katrina in 2009, the Haiti earthquake in 2010, and the Japanese tsunami in 2011. In hindsight, the effects of these disasters could have been mitigated by better preparation. In each instance readiness had been based narrowly on assumptions from past experience.

Thus, sensible local preparedness cannot be rutted exclusively in the known. Of course, drills should largely be based on likely scenarios with responders acting in prescribed roles. But some exercises should also include imaginative eventualities. Even if a conjured scenario seems improbable, the effort has value. Creative thinking, whether about the known or the unknown, is a necessary part of preparedness.

In the months leading to 9/11, American planners barely recognized the threat of multiple hijacked aircraft. But during that period, in the mountains of Afghanistan, Osama bin Laden

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was leading a group of cohorts with a different idea. His Al Qaeda operatives were not only conjuring an “improbable” scenario but they were also about to make it happen. Similarly for the four jihadi terrorists who planned and implemented 7/7. A determination by the commission that investigated the September 11 attacks applies no less to 7/7. “The most important failure,” the 9/11 Commission concluded, “was one of imagination.”<sup>40</sup>

Of course, no one can anticipate every manner of assault. But exercises that include surprise scenarios can broaden the mindset of responders to better address the unexpected. The field of terror medicine offers a more expansive approach both to expectation and readiness.

### TERROR MEDICINE

In May 2006, a year after the London bombings, Israeli authorities participated in a mock terror attack. The drill included more than a thousand personnel from the medical, police, fire, security, military, and other relevant communities. Participants knew in advance that a drill would take place at a certain time, but not about its nature or intended effects.

The exercise began with notification that a bomb had exploded in downtown Jerusalem resulting in numerous victims. Scores of mock patients began to arrive at the city’s Hadassah hospital. They bore symptoms not only of the kinetic effects of the explosion, but also of some sort of chemical exposure. The hospital doctors and staff were challenged to identify the toxic agent and begin treatment. The victims reported their symptoms and held cards describing rashes that many were ostensibly developing. In less than 30 minutes, the doctors determined that the chemical was hydrogen fluoride and they began mock treatment accordingly. (I was an on-site observer of the drill.)

Especially interesting was not just the mixture of ingredients—a bomb coupled with a chemical agent—but the agent itself. Hydrogen fluoride, an industrial chemical that is corrosive to human tissue, is a precursor in the production of highly lethal nerve agents. It is recognized as an accidental-release hazard, though a literature search indicates no instance of this chemical having been released for hostile purposes. Thus, unlike sarin, mustard gas, and other familiar chemical agents, hydrogen fluoride would be a less expected choice. Using this unlikely chemical in the drill helped expand the responders’ mindset beyond conventional expectations. Such thinking is but one aspect of terror medicine.

Terror medicine emerged as a distinctive medical field during the 5-year Palestinian uprising that began in 2000. In that period, Palestinians attempted some 20,000 terror attacks against Israelis.<sup>41</sup> More than 95% of them were thwarted, though still, about 1100 Israelis were killed and 6500 injured. The repeated attacks, including 150 suicide bombings, enabled Israelis to continually improve their techniques of rescue and treatment.

Among the concepts that arose from the Israeli experience were specific approaches to preparedness, incident management, treatment of injuries, and psychological consequences.<sup>42</sup> Israeli incident management, for example, became remarkably efficient. Although slower at the beginning of the uprising, toward the end, Israeli response time was remarkable. Following a terrorist bombing, 90% of the victims in need of hospitalization were commonly admitted within the first hour.<sup>43</sup> (Recall that after the London bus bombing 1 hour elapsed before even one of the victims reached a hospital.)

Features of terror medicine overlap with emergency and disaster medicine. But its singular characteristics range from treating exposures to a biological or chemical agent, like smallpox or sarin, to addressing the heightened emotional effects of a terrorist

assault. Another important feature relates to the manner of dealing with multiple traumatic injuries.

Such injuries could include burns, bone fractures, ruptured organs, severed blood vessels, and other blast and crush effects. The chance that a physician would see all of these wounds in a single individual ordinarily is near zero. Yet after a close-quarter suicide bombing, dozens of victims may bear most or all of these injuries. Terror medicine includes determining which patients to treat first and in what manner. It also involves quick removal of a patient from an incident site to minimize his exposure to a possible secondary attack at that site.

Another aspect of terror medicine relates to security. Some Palestinians on their way to Israeli hospitals were found to have hidden explosives under their clothing. As a result, a policy of selective searches was implemented including of those in need of medical attention. Further, several Palestinian ambulances were discovered to have been carrying weapons and gunmen.<sup>44</sup> Now, all vehicles, including Israeli ambulances carrying people in urgent need of care, are stopped at the perimeter of a hospital's grounds. Only after the vehicle is inspected is it permitted to reach the entryway.

In the case of a natural disaster, the principal role of the security official is to maintain order. In a terrorist event, the role expands to include protection against a deliberate threat. A responder, whatever her field—medicine, administration, trained volunteer, police—is expected to cope with all such threats, whether emanating from terrorist, accidental, or natural causes.

## ROADMAP FOR THIS BOOK

With appreciation for the breadth of a responder's roles, the introductory part of this book (Chapters 1–3) underscores the importance of communication and coordination during all such events. A sense of that importance continues as well through the book's three additional parts: the roles of health responders, of institutional managers, and of support and security personnel. Each part includes chapters by one or more experts in a specific field.

Every chapter's case study and follow-up assessment covers the quality of preparedness for that discipline. The chapters also make reference to coordination with responders from other fields. The aim is to discern the strengths and weaknesses of local preparedness from the vantage of key responder groups. As was clear in this chapter, good communication both within and between groups is central to the process. When medical responders to an event are well prepared but law enforcement responders are not—or vice versa—the outcome is jeopardized. Equally important, if responder groups are individually prepared, but not practiced at coordinating with each other, response efforts can be muddled.

The concluding chapter reviews the lessons provided throughout the book. It returns to a theme alluded to in this introductory section: preparation for the unknown as well the known. Approaching preparedness with an open mind and practiced interaction among responder groups could be essential to mitigating the effects of the next *black swan*.

## NOTES

1. Details about Sam Ly's life were drawn from his friend's Web site and augmented by media reports. See "Will's Blog." July/August 2005. Available at <http://will.id.au/blog/archive/2005/08>,

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