

Physical Health of Members of the Public Who Experienced Terrorist Bombings in London on 07 July 2005

Michael A. Catchpole, FRCP; Oliver Morgan, PhD

On behalf of the London Bombings Steering Group, Health Protection Agency, Centre for Infections, London, UK

Correspondence:

Michael Catchpole
Deputy Director
Centre for Infections
Health Protection Agency
61 Colindale Avenue
London NW9 5EQ UK
E-mail: mike.catchpole@hpa.org.uk

A copy of the questionnaire can be found at:
[http://pdm.medicine.wisc.edu/Volume_25/issue_2/Complete Questionnaire.pdf](http://pdm.medicine.wisc.edu/Volume_25/issue_2/Complete%20Questionnaire.pdf)

Keywords: bombings; follow-up; hearing loss; London; London bombings; physical health effects; registers; underground

Abbreviations:

HPA = Health Protection Agency
NHS = National Health Service
PTSD = post-traumatic stress disorder

Received: 27 March 2009

Accepted: 04 May 2009

Revised: 07 July 2009

Web publication: 29 March 2010

Abstract

Introduction: On 07 July 2005, four bombs were detonated in London, killing 52 members of the public. Approximately 700 individuals received treatment either at the scene or at nearby hospitals.

Hypothesis/Problem: Significant concerns about the potential long-term psychological and physical health effects of exposure to the explosions were raised immediately after the bombings. To address these concerns, a public health register was established for the purpose of following-up with individuals exposed to the explosions.

Methods: Invitations to enroll in the register were sent to individuals exposed to the explosions. A range of health, emergency, and humanitarian service records relating to the response to the explosions were used to identify eligible individuals. Follow-up was undertaken through self-administered questionnaires. The number of patients exposed to fumes, smoke, dust, and who experienced blood splashes, individuals who reported injuries, and the type and duration of health symptoms were calculated. Odds ratios of health symptoms by exposure for greater or less than 30 minutes were calculated.

Results: A total of 784 eligible individuals were identified, of whom, 258 (33%) agreed to participate in the register, and 173 (22%) returned completed questionnaires between 8 to 23 months after the explosions. The majority of individuals reported exposure to fumes, smoke, or dust, while more than two-fifths also reported exposure to blood. In addition to cuts and puncture wounds, the most frequent injury was ear damage. Most individuals experienced health symptoms for less than four weeks, with the exception of hearing problems, which lasted longer. Four-fifths of individuals felt that they had suffered emotional distress and half of them were receiving counseling.

Conclusions: The results indicated that the main long-term health effects, apart from those associated with traumatic amputations, were hearing loss and psychological disorders. While these findings provide a degree of reassurance of the absence of long-term effects, the low response rate limits the extent to which this can be extrapolated to all those exposed to the bombings. Given the importance of immediate assessment of the range and type of exposure and injury in incidents such as the London bombings, and the difficulties in contacting individuals after the immediate response phase, there is need to develop better systems for identifying and enrolling exposed individuals into post-incident health monitoring.

Catchpole MA, Morgan O: Physical health of members of the public who experienced terrorist bombings in London on 07 July 2005. *Prehosp Disaster Med* 2010;25(2):139–144.

Introduction

During the London morning rush hour of Thursday 07 July 2005, terrorist bombs exploded on three underground trains and one bus in Central London. Fifty-two passengers and four suicide bombers were killed, and approximately 700 individuals received treatment either at the scene or at nearby hospitals.^{1,2}

Post-disaster health registries have been used for evaluating long-term health effects after many incidents similar to the bombings in London.³ The evidence on the psychological effects of exposure to such events has been well documented, with survivors reported as suffering symptoms of post-traumatic stress disorder (PTSD) up to two years after the exposure,⁴⁻⁷ and with evidence that physical injury increases the risk of PTSD, irrespective of the cause.^{8,9} However, less is known about the nature and natural history of long-term physical health effects. After certain incidents, many survivors will attribute physical symptoms to exposure despite no corroborating medical evidence, although it is not clear why some incidents result in such syndromes and others do not.¹⁰ More than half of the survivors of collapsed and damaged buildings in the World Trade Center in 2001 self-reported new or worsening respiratory symptoms in a follow-up, and 21% reported severe headaches two to three years after the events despite few sustaining serious injury.¹¹ Twenty-two percent of the survivors of the Oklahoma City bombing in 1995 reported worsening of pre-existing asthma and bronchitis in the one and a half to three years following the incidents.¹² In contrast, following the Boeing 707 crash in Amsterdam, general practitioners related only 6% of all self-reported symptoms to the incident.¹³

The collation of exposure and physical health data in the short- and medium-term after the explosions in London prompted the issuing of guidance and advice on post-exposure prophylaxis for blood borne viruses and on the clinical assessment of blast lung injury. The absence of chemical, biological, radiological, or nuclear (CBRN) agents quickly was confirmed, but long-term health effects among members of the public remained a concern, including delayed physical and mental health impacts. To address this concern, a follow-up register was compiled of members of the public who experienced the explosions. The register was established and managed by a steering group that included the Health Protection Agency (HPA), the National Health Service (NHS) in London, the London Trauma Response Service (which provided psychological screening and treatment services), the emergency services, Transport for London, and the Metropolitan Police. This paper describes the process used to follow-up with individuals exposed to the London bombings, and presents the findings of that follow-up with regards to exposures and health impacts, particularly the physical effects. The paper also describes the challenges of establishing a health register for public health monitoring after a major incident.

Methods

Establishment of a Health Register

A register was compiled of members of the public who experienced the terrorist bombings on 07 July 2005. Individuals were eligible for inclusion if they were members of the public (i.e., not emergency responders or London Transport employees), and were in the vicinity of any of the bombings. Vicinity was defined as: (1) trains on which a bomb exploded or from which passengers had to be evacuated through the underground tunnels; (2) platforms, escalators, lifts, ticket halls, or passage ways at Edgware Road,

Kings Cross, Liverpool Street, and Russell Square stations; and (3) within such range of the bus explosion in Tavistock Square as to have been directly exposed to fumes, smoke, blood or, the shock wave of the explosion. Eligible individuals who had contact with healthcare services were identified retrospectively by reviewing data from several sources in and around London, including: (1) hospital emergency departments; (2) the Metropolitan Police 7th July Major Incident Casualty Database; (3) NHS Direct (a nurse-led telephone health advisory service); (4) Minor Injuries Units; (5) General Practitioners; and (6) the London Ambulance Service. Eligible individuals who did not have immediate contact with healthcare services after the event were identified from: (1) the NHS London Trauma Screening Team, which offered screening and treatment for psychological problems to anyone affected by the bombings; (2) the 7th July Assistance Centre; (3) the Department of Culture, Media and Sport, Victim Support; (3) the 7th July Committee of the London Assembly; and (4) the survivors' self-help group Kings Cross United. An invitation to participate in the register was published on the HPA Website. Invitations to participate also were given in media interviews, although no general invitation was issued proactively through media channels. All eligible individuals were sent an invitation by post to be included in a London Bombings health register and a self-completion questionnaire sent to those who agreed.

Self-Completion Questionnaire

Register members were asked to complete a questionnaire about exposures, injury, and any subsequent health problems thought to be related to the bombings. Exposure information included in the questionnaire covered individuals' location at the time of the explosions, the length of time spent at the scene, and their perceived exposure to fumes, smoke, dust, and/or blood splashes from other victims. Outcome variables included physical and mental health complaints and their duration that were encountered as a result of the explosions, but not restricted to those that respondents sought treatment for, including physical injuries, and problems with vision, hearing, breathing, cough, headaches, dizziness, or any other relevant symptoms experienced in the one or two days after the event, if these symptoms persisted and for how long, and whether medical care had been sought and was ongoing. Emotional problems were as self-declared, using questions that had been validated in previous assessments for evidence of PTSD among victims of major incidents.¹⁴ Respondents also were asked about any mental health advice they had received prior to or after the incident. Questionnaires were validated by piloting (which included seeking qualitative feedback on the questionnaire) among a small number of register members before being sent to all members between March 2006 and April 2007.

Statistical Processing

For individuals who experienced the train and bus explosions separately, the proportion exposed to fumes, smoke, dust, and who experienced blood splashes was calculated. The proportion of individuals who reported injuries, and the

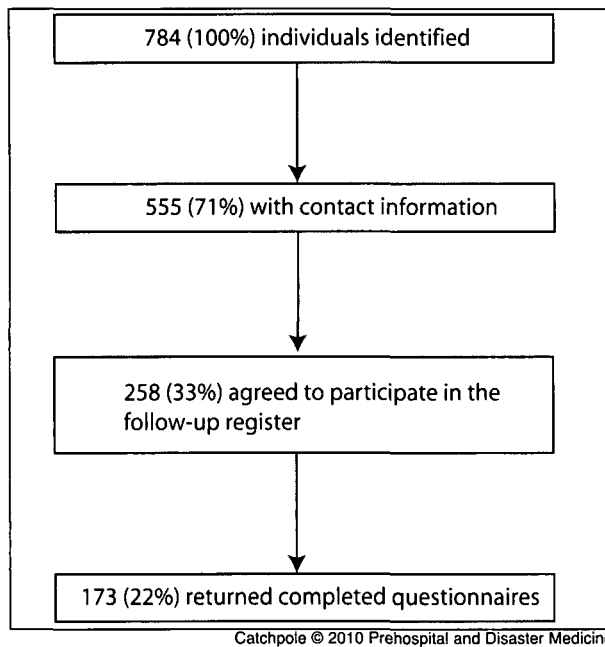


Figure 1—Individuals included in the register and who completed questionnaires

type and duration of health symptoms also was calculated. For individuals who were exposed to explosions on the trains, odds ratios of health symptoms by having been exposed for more or less than 30 minutes (the median duration of exposure) were calculated. Processing was done using STATA version 8.2 (STATA Corp., College Station, TX).

Results

Recruitment to the Register and Questionnaire Responses

A total of 784 eligible individuals were identified from available data sources (Figure 1). Four hundred sixty-four (59%) were identified from hospital emergency departments, 291 (37%) were recorded by the Metropolitan Police major incident casualty database, 14 (2%) from the London Ambulance Service, and 16 (2%) from minor injury units and walk-in centers. No individuals were identified through General Practice physicians. Of individuals identified, 555 (71%) had sufficient contact information needed to invite them to join the register. Of these, 258 (33%) agreed to participate in the register and 173 (22%) returned completed questionnaires. Questionnaires were completed between eight to 23 months (median 11 months) after the explosions.

Forty-two percent of respondents were male and the median of the ages was 35 years (range of 15 to 71). One hundred fifty-four (89%) individuals experienced an explosion on one of the trains, and 19 (11%) on the bus. There was no difference in the characteristics of individuals who did and did not participate in the register (Table 1).

Exposures

Of 154 individuals who experienced the explosions on the trains, 152 (99%) reported exposure to fumes, smoke, and/or dust as a result of the explosions. The median duration of exposure, reported by 137 respondents, was 30 minutes (range 5 to 180 minutes). Sixty-one individuals (40%) report-

ed being splashed with blood during the explosion or while helping other individuals. Six of 19 individuals (32%) who experienced the explosion on the bus reported exposure to fumes, smoke, or dust, with a median duration of exposure of five minutes (range 5 to 7.5 minutes). Nine of the 19 (47%) reported coming into contact with blood from splashes or contact with other victims.

Injuries

From the explosions on the trains, 60% ($n = 92/154$) reported being injured, as were 74% ($n = 14/19$) of individuals who experienced the explosion on the bus. The most frequently reported injuries from the train explosions were cuts and grazes (48%), ear damage (39%), puncture wounds (37%), burns (20%), head injuries (18%), and eye injuries (16%). Other injuries included broken bones ($n = 11$), loss of a limb ($n = 5$), and broken teeth ($n = 3$). The explosion on the bus mostly caused ear damage (60%), cuts and grazes (52%), puncture wounds (42%), head injuries (21%), burns (20%), and broken bones (16%). Other injuries included eye injuries ($n = 1$), loss of a limb ($n = 1$), and broken teeth ($n = 1$).

Health Symptoms

The most frequently reported health symptom after the tube explosions was cough (61%), followed by headaches or dizziness (52%), breathing problems (50%), hearing problems (49%), and vision problems (23%) (Table 2). Most individuals did not experience health symptoms longer than four weeks. However, half of the individuals reporting problems continued to have hearing symptoms four weeks after the explosions. For individuals who experienced the bus explosion, a hearing problem was the most commonly reported symptom (63%), followed by headaches or dizziness (47%), and vision problems (37%).

Odds ratios for exposure to fumes, smoke, or dust and health symptoms in the first two days after the train explosions are in Table 3. Being exposed for >30 minutes was not statistically associated with cough, headaches or dizziness, and/or breathing or hearing problems. However, individuals reporting vision problems were more likely to have been exposed for >30 minutes (OR = 2.27, 95% CI = 1.06 to 4.85, $p = 0.03$).

Of all 173 individuals that completed the questionnaire, 138 (80%) felt that they had suffered emotionally as a result of the bombings and 53 (38%) of these individuals were still receiving counseling at the time of completing the questionnaire.

Healthcare Utilization

Twenty percent ($n = 34$) of respondents were admitted to hospital, 42% ($n = 72$) were treated in emergency departments and 26% ($n = 45$) visited walk-in clinics, consulted their general practitioner or contacted NHS Direct for advice. Twenty-one (12%) sought no medical care.

Discussion

Individuals who experience terrorist attacks and major disasters may experience ongoing health problems, even when no causative exposures occurred.¹³ However, this is not consistent for all disasters¹⁰ and only a small proportion of individuals reported having health symptoms that lasted for

	Follow-Up Questionnaire Completed			Follow-Up Questionnaire Not Completed			p-value	Data not available
	n	N	(%)	n	N	(%)		
Male	75	173	(43)	161	381	(42)	0.8	--
Median age (Range)	36	173	(15–71)	32	381	(11–81)	0.2	--
Travelling on Bus	19	173	(11)	36	257	(14)	0.4	124
Travelling on Trains	155	173	(89)	221	257	(86)	0.4	124
Injured	105	173	(61)	121	213	(57)	0.5	168
Hospitalized	34	173	(20)	58	381	(15)	0.2	--
No medical care	21	173	(12)	54	381	(14)	0.5	--

Catchpole © 2010 Prehospital and Disaster Medicine

Table 1—Characteristics of individuals who did and did not complete the follow-up questionnaire

Symptom	Symptom Reported	Minutes exposed to fumes, smoke, or dust		Odds Ratio	95% CI	p-value
		30+	≤30			
Cough	Yes	42	24	1.21	0.63 to 2.34	0.57
	No	52	36			
Headache or dizziness	Yes	37	29	1.28	0.67 to 2.24	0.46
	No	44	44			
Breathing problems	Yes	36	30	1.38	0.73 to 2.61	0.33
	No	41	47			
Hearing problems	Yes	33	33	1.05	0.55 to 1.98	0.9
	No	43	45			
Vision problems	Yes	21	45	2.27	1.06 to 4.85	0.03
	No	15	73			

Catchpole © 2010 Prehospital and Disaster Medicine

Table 2—Reported symptoms following explosion of terrorist bombs on three London Underground trains and one bus, 07 July 2005

Symptom	Individuals who Experienced Train Explosions (n = 154)						Individuals who Experienced Bus Explosions	
	n	(%)	Duration of symptoms (%)				n	(%)
			1–2 days	3–7 days	8–28 days	28+ days		
Coughing	94	(61)	(65)	(18)	(9)	(9)	3	(16)
Headaches or dizziness	81	(52)	(64)	(7)	(11)	(17)	9	(47)
Breathing problems	77	(50)	(61)	(18)	(5)	(16)	5	(26)
Hearing problems	76	(49)	(28)	(8)	(9)	(55)	12	(63)
Vision problems	36	(23)	(39)	(25)	(19)	(17)	7	(37)

Catchpole © 2010 Prehospital and Disaster Medicine

Table 3—Odds ratio for >30 minutes exposure to fumes, smoke, or dust and symptoms reported by individuals (n = 154) who experienced explosion of terrorist bombs on three London Underground trains, 07 July 2005

four weeks or longer. Hearing problems, which are common after bomb explosions,^{12,15,16} were a notable exception, with nearly 55% of individuals reporting problems after four weeks. A similar proportion of individuals reported hearing problems following the terrorist bombings in Madrid (41%) and Oklahoma City bombing (49%).

A risk and hazard assessment conducted immediately after the explosions concluded that the risk of exposure to several environmental agents inside the underground tunnels was low, including exposure to asbestos, mercury, components of thermal switches (liquid sodium-potassium alloy in fiberglass cover, surrounded by oil) and materials from acid-lead batteries.¹⁷ The risk of respiratory problems arising from exposure to tunnel dust also was assessed as low. Consequently although individuals reported a cough or difficulty breathing in the first few days after the tube explosions, most had no respiratory symptoms by four weeks. Moreover, the length of time spent in the tunnels after the explosions was not associated with reporting health symptoms, except for vision problems, which may have been due to eye irritation from dust exposure.

Health Monitoring Following Future Incidents

Initiating health follow-up after the London terrorist bombings took a number of months, although eligible individuals were identified in the week after the incident. The delay was, in part, due to conflicting interpretations by responding agencies of the Data Protection Act, which governs the sharing of data about individuals. Delays in follow-up also have been reported following other events, limiting the potential to identify the relevant individuals and their health symptoms.^{18,19} Emergency planning should include consideration of when and how health follow-up should be implemented. The benefits of applying health follow-up protocols include identification of previously unrecognized public health problems, such as respiratory symptoms among New York residents following the World Trade Center disaster.²⁰ Conversely, timely follow-up also may allay concerns by showing an absence of health impacts, such a register of emergency responders after the Buncefield oil depot fire in England in December 2005.²¹

These results demonstrate how longer-term health monitoring of physical health effects can provide reassurance of absence of long-term effects. Given the importance of immediate assessment of the range and type of exposure and injury to both acute and long-term responses to incidents such as the London bombings, and the difficulties in contacting individuals after the immediate response phase, there is need to develop better systems for identifying and enrolling exposed individuals into post-incident health monitoring. This would be facilitated by the development and testing of protocols for identification and enrolment of individuals, particularly ambulant cases, while in emergency departments, e.g., by rapidly deploying field epidemiology officers to receiving departments. For individuals that are not seen in emergency departments, there also is a need for

agreed protocols and appropriate scripts for enrolment through emergency telephone help-line centers and public media announcements.

Limitations

Not all individuals who experienced the explosions on the trains or bus could be systematically identified, but the authors relied on records gathered by health services and the police. However, many survivors interviewed as part of the London Assembly's review of the incident did not know about the option to participate in the health follow-up. Alternative strategies to identify individuals eligible for follow-up, such as announcements via the media, may have reached more of the affected individuals.

Of the individuals that were identified, only a small proportion (27%) completed the questionnaire. This reflects the difficulty of following-up individuals in major metropolitan areas: in some parts of London, as much as 35% of the population changes address each year. Previous studies also have shown that following disasters, individuals who respond to follow-up programs are more likely to be injured or perceive being exposed to a health hazard.^{22,23} This suggests that participants in the health follow-up were more likely to have experienced an impact on their physical health.

While individuals were asked about their exposure to blood splashes as a result of the explosions and while attending to other victims, it was not possible to assess if this led to infection with blood borne pathogens. Little information is available about the potential risk from blood-borne infections. Only one case of hepatitis B virus (HBV) infection following a bomb blast has been published, caused by a bone fragment after detonation of a suicide bomb in Israel.²⁴ A risk assessment approach for blood borne infections and tetanus following bombings and mass-casualty events subsequently has been published by the Centers for Disease Control and Prevention.²⁵

Conclusions

In a sample of individuals who experienced explosions due to terrorist bombings in London on 07 July 2005, many reported injuries such as cuts, puncture wounds, and hearing loss. Physical health symptoms were short-lived and few reported symptoms after four or more weeks following the incident, with the exception of hearing problems. Health symptoms did not appear to be associated with self-reported exposure to fumes, dust, and smoke in the underground train tunnels. In contrast, a significant proportion of individuals who experienced the bombings reported emotional distress, with several still receiving counseling many weeks or months after the event. The interpretation of these results in terms of the experience of all those exposed to the bombs in London in July 2005 is hampered by the low proportion of those exposed that were enrolled. This is a common problem in such health follow-ups, and better systems for identifying and enrolling exposed individuals into post-incident health monitoring are required.

References

- Intelligence and Security Committee. Report into the London Terrorist Attacks on 7 July 2005. Available at http://www.cabinetoffice.gov.uk/publications/reports/intelligence/govres_7july.pdf. Accessed 15 May 2006.
- Ryan J, Montgomery H: The London attacks—Preparedness: Terrorism and the medical response. *N Engl J Med* 2005;353(6):543–545.
- Agency for Toxic Substances and Disease Registry: Proceedings: Expert Panel on Public Health Registries, May 13th, 2004. ASTDR, Atlanta, 2004.
- Whalley MG, Brewin CR: Mental health following terrorist attacks. *Brit J Psychiatry* 2007;190:94–96.
- Brewin CR, Andrews B, Valentine JD: Meta-analysis of risk factors for post-traumatic stress disorder in trauma-exposed adults. *J Consult Clin Psychol* 2000;68:748–766.
- Holbrook TL, Hoyt DB, Stein MB, Sieber WJ: Gender differences in long-term posttraumatic stress disorder outcomes after major trauma: Women are at higher risk of adverse outcomes than men. *J Trauma* 2002;53:882–888.
- North CS, Pfefferbaum B, Tivis, Kawasaki A, Reddy C, Spitznagel EL: The course of post traumatic stress disorder in a follow-up study of survivors of the Oklahoma City bombing. *Ann Clin Psychiatry* 2004;16:209–215.
- Johansen VA, Wahl AK, Eilertsen DE, Weisaeth L: Prevalence and predictors of post-traumatic stress disorder (PTSD) in physically injured victims of non-domestic violence. A longitudinal study. *Soc Psychiatry Psychiatr Epidemiol* 2007;42:583–593.
- Grieger TA, Cozza SJ, Ursano RJ, Hoge C, Martinez PE, Engel CC, Wain HJ: Posttraumatic stress disorder and depression in battle-injured soldiers. *Am J Psychiatry* 2006;163:1777–1783.
- Rubin J, Wessely S: Psychological reactions to the London bombings. *The Magazine of the Health Protection Agency* 2007;7:20–22.
- Brackbill RM, Thorpe LE, DiGrande L, Perrin M, Sapp JH, Wu D, Campolucci S, Walker DJ, Cone J, Pulliam P, Thalji L, Farfel MR, Thomas P: Surveillance for World Trade Center disaster health effects among survivors of collapsed and damaged buildings. *MMWR Surveillance Summ* 2006;55:1–18.
- Shariat S, Mallonee S, Kruger E, Farmer K, North C: A prospective study of long-term health outcomes among Oklahoma City bombing survivors. *J Okla State Med Assoc* 1999;92(4):178–186.
- Donker GA, Yzermans CJ, Spreeuwenberg P, van der Zee J: Symptom attribution after a plane crash: comparison between self-reported symptoms and GP records. *Br J Gen Pract* 2002;52(484):917–922.
- Brewin CR, Rose S, Andrews B, Green J, Tata P, McEvedy C, Turner S, Foa EB: Brief screening instrument for post-traumatic stress disorder. *Br J Psychiatry* 2002;181:157–162.
- Cohen JT, Ziv G, Bloom J, Zikk D, Rapoport Y, Himmelfarb MZ: Blast injury of the ear in a confined space explosion: auditory and vestibular evaluation. *Isr Med Assoc J* 2002;4(7):559–562.
- de Ceballos JP, Turegano-Fuentes F, Perez-Diaz D, Sanz-Sanchez M, Martin-Llorente C, Guerrero-Sanz JE: 11 March 2004: The terrorist bomb explosions in Madrid, Spain—An analysis of the logistics, injuries sustained and clinical management of casualties treated at the closest hospital. *Crit Care* 2005;9(1):104–111.
- Wilson J, Murray V, Kettle: The July 2005 London Bombings: Environmental monitoring for non-infectious materials release, and initial health risk assessment. *Chemical Hazards and Poisons Report* 2008;12:11–13.
- Boscarino JA, Figley CR, Adams RE, Galea S, Resnick H, Fleischman AR, Bucuvalas M, Gold J: Adverse reactions associated with studying persons recently exposed to mass urban disaster. *J Nerv Ment Dis* 2004;192(8):515–524.
- Weisaeth L: Importance of high response rates in traumatic stress research. *Acta Psychiatr Scand Suppl* 1989;355:131–137.
- Braverman I, Wexler D, Oren M: A novel mode of infection with hepatitis B: Penetrating bone fragments due to the explosion of a suicide bomber. *Isr Med Assoc J* 2002;4(7):528–529.
- Centers for Disease Control and Prevention: Recommendations for postexposure interventions to prevent infection with Hepatitis B virus, Hepatitis C virus, or human immunodeficiency virus, and tetanus in persons wounded during bombings and similar mass-casualty events—United States, 2008. *MMWR* 2008;57:(No RR-6).
- Bascetta C: September 11. Monitoring of World Trade Center health effects has progressed, but not for federal responders. A testimony before the Subcommittee on National Security, Emerging Threats and International Relations, Committee on Government Reform, [US] House of Representatives, 2006, p 19.
- Slotje P, Huizink AC, Twisk JW, Witteveen AB, van der Ploeg HM, Bramsen I, Smidt N, Bijlsma JA, Bouter LM, van Mechelen W, Smid T: Epidemiological study air disaster in Amsterdam (ESADA): Study design. *BMC Public Health* 2005;5:54.
- Landrigan PJ, Lioy PJ, Thurston G, Berkowitz G, Chen LC, Chillrud SN, Gavett SH, Georgopoulos PG, Geyh AS, Levin S, Perera F, Rappaport SM, Small C, the NIEHS World Trade Center Working Group: Health and environmental consequences of the world trade center disaster. *Environ Health Perspect* 2004;112(6):731–739.
- Morgan O, Verlander NQ, Kennedy F, Moore M, Birch S, Kearney J, Lewthwaite P, Lewis R, O'Brian S, Osman J, Reacher M: Exposures and reported symptoms associated with occupational deployment to the Buncefield fuel depot fire, England 2005. *Occup Environ Med* 2008;65(6):404–411.