Handbook of Bioterrorism and Disaster Medicine
Handbook of Bioterrorism and Disaster Medicine

Edited by

Robert E. Antosia
Harvard Medical School
and
Department of Emergency Medicine
Beth Israel Deaconess Medical Center
Boston, Massachusetts, USA

John D. Cahill
Department of Emergency Medicine and
Division of Infectious Diseases
St. Luke’s/Roosevelt Hospital Center
New York, New York, USA

Springer
Amesh Adalja, M.D., Department of Emergency Medicine, Allegheny General Hospital, Drexel University College of Medicine, Pittsburgh, Pennsylvania, USA

Mara Aloi, M.D., Department of Emergency Medicine, Allegheny General Hospital, Drexel University College of Medicine, Pittsburgh, Pennsylvania, USA

Phillip Anderson, M.D., Harvard Medical School, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

Robert Antosia, M.D., M.P.H., Harvard Medical School, and Department of Emergency Medicine, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

Robert Buckner II, M.D., Department of Emergency Medicine, Allegheny General Hospital, Drexel University College of Medicine, Pittsburgh, Pennsylvania, USA

Frederick Burkle, M.D., M.P.H., The Center for International Emergency, Disaster and Refugee Studies, The John Hopkins University Medical Institutions, Baltimore, Maryland, USA

Michelle Burns, M.D., Children’s Hospital, Harvard Medical School, Boston, Massachusetts, USA

John D. Cahill, M.D., Department of Emergency Medicine and Division of Infectious Diseases, St. Luke’s/Roosevelt Hospital Center, Columbia College of Physicians and Surgeons, New York, New York, USA

Christopher Cammarata, M.D., Department of Emergency Medicine, Allegheny General Hospital, Drexel University College of Medicine, Pittsburgh, Pennsylvania, USA

Anna Chen, M.D., Harvard Medical School, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

Scott Cohen, M.D., Global Pediatric Alliance, Oakland, California, USA

Manuel Colon, M.D., Department of Emergency Medicine, St. Luke’s/Roosevelt Hospital Center, Columbia College of Physicians and Surgeons, New York, New York, USA

Marina Del Rios, M.D., Department of Emergency Medicine, St. Luke’s/Roosevelt Hospital Center, Columbia College of Physicians and Surgeons, New York, New York, USA
Alexandra Epee-Bounya, M.D., Children’s Hospital Boston, Harvard Medical School, Boston, Massachusetts, USA

Stephen Epstein, M.D., M.P.P., Harvard Medical School, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

Megan Fix, M.D., Brigham and Women’s Hospital, Harvard Medical School, Boston, Massachusetts, USA

Medley Gatewood, M.D., Brigham and Women’s Hospital, Harvard Medical School, Boston, Massachusetts, USA

Ann-Jeannette Geib, M.D., Children’s Hospital, Harvard Medical School, Boston, Massachusetts, USA

Frank Guyette, M.D., Department of Emergency Medicine, University of Pittsburgh Medical Center, University of Pittsburgh, Pittsburgh, Pennsylvania, USA

Dennis Hanlon, M.D., Department of Emergency Medicine, Allegheny General Hospital, Drexel University College of Medicine, Pittsburgh, Pennsylvania, USA

Fred M. Harchelroad, M.D., Department of Emergency Medicine, Allegheny General Hospital, Drexel University College of Medicine, Pittsburgh, Pennsylvania, USA

Richard V. Hausrod, M.D., Department of Emergency Medicine, Allegheny General Hospital, Drexel University College of Medicine, Pittsburgh, Pennsylvania, USA

Michael Hoffman, Office of International Humanitarian Affairs, American Red Cross, Washington, D.C., USA

Liudvikas Jagminas, M.D., Department of Emergency Medicine, Memorial Hospital, Pawtucket, Rhode Island, USA

Catherine James, M.D., Children’s Hospital, Harvard Medical School, Boston, Massachusetts, USA

Sarah M. Kelmenson, M.D., Department of Emergency Medicine, Rhode Island Hospital, Brown University, Providence, Rhode Island, USA

Kristin Kent, M.D., Department of Emergency Medicine, St. Luke’s/Roosevelt Hospital Center, Columbia College of Physicians and Surgeons, New York, New York, USA

Barbara Kilian, M.D., Department of Emergency Medicine, St. Luke’s/Roosevelt Hospital Center, Columbia College of Physicians and Surgeons, New York, New York, USA

Kevin King, M.D., Department of Emergency Medicine, Boston University, Boston, Massachusetts, USA

Atul Kukar, M.D., Division of Cardiology, St. Luke’s/Roosevelt Hospital Center, Columbia College of Physicians and Surgeons, New York, New York, USA

Rashid Kysia, M.D., M.P.H., Brigham and Women’s Hospital, Harvard Medical School, Boston, Massachusetts, USA

Jerry Lambert, M.D., Department of Emergency Medicine, Allegheny General Hospital, Drexel University College of Medicine, Pittsburgh, Pennsylvania, USA
Kaushal Shah, M.D., Department of Emergency Medicine, St. Luke’s/Roosevelt Hospital Center, Columbia College of Physicians and Surgeons, New York, New York, USA

Michael Shannon, M.D., Children’s Hospital, Harvard Medical School, Boston, Massachusetts, USA

Sam Shen, M.D., M.B.A., Harvard Medical School, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA


George W. Skarbek-Borowski, M.D., Department of Emergency Medicine, Memorial Hospital, Brown University, Pawtucket, Rhode Island, USA

Dorsett D. Smith, M.D., Division of Pulmonary Disease and Critical Care, Department of Medicine, University of Washington, Seattle, Washington, USA

Ramona Sunderwirth, M.D., Department of Emergency Medicine, St. Luke’s/Roosevelt Hospital Center, Columbia College of Physicians and Surgeons, New York, New York, USA

Stephen Traub, M.D., Harvard Medical School, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

Deborah Weiner, M.D., Ph.D., Children’s Hospital, Harvard Medical School, Boston, Massachusetts, USA

Dan Wiener, M.D., Department of Emergency Medicine, St. Luke’s/Roosevelt Hospital Center, Columbia College of Physicians and Surgeons, New York, New York, USA

Tommy Wong, M.D., Department of Emergency Medicine, St. Luke’s/Roosevelt Hospital Center, Columbia College of Physicians and Surgeons, New York, New York, USA

Tracy H. Zivin-Tutela, M.D., Division of Infectious Diseases, St. Luke’s/Roosevelt Hospital Center, Columbia College of Physicians and Surgeons, New York, New York, USA
To all victims of terrorism or disaster throughout the world
I am indebted to Andrea Macaluso from Springer for her patience and faith in this book. A special thanks to Aaron Johnson for helping to get this project off the ground, to Tim Oliver for his expertise in copyediting and typesetting, and to Mara Aloi MD for all her efforts and help. Thank you to all the contributing authors, for this book would not have been possible without them.

Finally, thanks to my wife Rachel for her endless support and help with this project.

—John D. Cahill

Numerous people have helped and supported me in my endeavors. Most especially, I thank my mother and father for showing me the right path and for their endless love and support.

I would also like to acknowledge Dr. Bert Woolard for introducing me the specialty of Emergency Medicine; Drs. Dave Wagner, Jim Roberts, Bob McNamara, and Thomas Alessi for showing me what an emergency physician is and for being such great role models; Dr. Jennifer Leaning for both helping me and inspiring me to understand the need to enhance disaster medical care throughout the world—and the passion for making a difference; and Dr. Troy Brennan for his mentoring and unwavering support.

Finally, I wish to thank my wife Janelle; she gives me the love and strength to follow on the path.

—Robert E. Antosia
The Handbook of Bioterrorism and Disaster Medicine was created because we felt there was no effective handbook that covered the breadth and scope of this field. Our book incorporates concise chapters, on topics and diseases with abundant web-based references, and careful organization. We hope that all healthcare providers interested or involved with the care of victims of bioterrorism or disaster — including prehospital care providers, medical students, nurses, physicians, and those involved with public health or humanitarian aide — find it indispensable.

We wish to thank the numerous authors who contributed to this handbook. Throughout the book, consistency of style and depth provide the reader with easy and reliable access to the vast amount of information needed to understand, prepare for, and deal with a bioterrorist attack or disaster. The chapters in this book have been based on scientific studies and data when available. However, more research is needed to more fully understand these complex events.

These events often occur with little or no warning, and they typically disproportionately harm the very young, the very old, and the impoverished.
## Contents

### I. General Concepts
1. Defining a Disaster ............................................ 3
2. Early Warning Systems ..................................... 5
3. Epidemiology of Disasters ................................. 7
4. Triage .......................................................... 11
5. Disaster Logistics ........................................... 19
6. Public Health Preparedness ............................... 23
7. Intergovernmental and Governmental Organizations .... 25
8. Nongovernmental Organizations ......................... 29
9. Complex Humanitarian Emergencies .................... 31

### II. Natural Disasters
10. Earthquakes .................................................. 39
11. Volcanoes ................................................... 43
12. Floods ....................................................... 49
13. Tsunamis ..................................................... 53
14. Hurricanes and Typhoons ............................... 57
15. Tornadoes .................................................... 61
16. Drought ....................................................... 65
17. Firestorms and Wildfires ................................ 67
18. Heat Wave/Hyperthermia ................................ 73
19. Winter Storm Disasters and Hypothermia ............ 79

### III. Bioevents and Manmade Disasters
20. The Epidemiology of War and Conflict ............... 89
21. Weapons of Mass Destruction ........................... 95
22. Anthrax ..................................................... 101
23. Smallpox .................................................... 105
24. Plague ....................................................... 109
25. Tularemia .................................................... 115
26. Viral Hemorrhagic Fevers .................................................. 119
27. Botulism .............................................................................. 125
28. Q Fever ............................................................................... 129
29. Brucellosis ........................................................................... 133
30. Alphaviruses ........................................................................ 137
31. Ricin ................................................................................... 143
32. Epsilon Toxin .......................................................................... 147
33. Staphylococcus Enterotoxin B .................................................... 149
34. Food- and Water-borne Agents .................................................. 151
35. Melioidosis ............................................................................ 157
36. Nerve Agents ........................................................................ 161
37. Vesicants ............................................................................... 167
38. Pulmonary Agents .................................................................... 171
39. Cyanides ............................................................................... 177
40. Nuclear Detonation/Ionizing Radiation Exposure ............................. 183
41. Hazardous Material Disasters .................................................... 189
42. Maritime Disasters .................................................................. 193
43. Aviation Disasters .................................................................. 197

IV. MEDICAL MANAGEMENT OF DISASTER-RELATED INJURIES AND DISEASE

IVA. BASIC EMERGENCY MEDICINE

44. The ABCs and Resuscitation Algorithms for Cardiopulmonary Arrest .................................................. 203
45. Shock: Diagnosis and Management .............................................. 207
46. Intravenous Fluid Requirements and Blood Products .................. 211
47. Decontamination ..................................................................... 217
48. Acute Inhalation Injury ............................................................ 227
49. Electrical Injuries .................................................................... 235
50. Toxicology ............................................................................. 239

IVB. INFECTIOUS DISEASES OF DISASTER

51. Measles ................................................................................. 245
52. Approach to Diarrhea and Dysentery .......................................... 249
53. Malaria ................................................................................. 253
54. Meningitis and Encephalitis ....................................................... 259
55. Tuberculosis ........................................................................... 265
56. Human Immunodeficiency Virus, Type 1, and AIDS ......................... 271
57. Sexually Transmitted Diseases ................................................... 275
58. Schistosomiasis ....................................................................... 279
59. Tetanus .................................................................................. 285
60. Bite Wounds and Rabies ............................................................ 291
61. Tick-Borne Diseases ................................................................ 299
62. Leptospirosis .......................................................................... 307
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVC.</td>
<td>Basic Trauma Management</td>
<td></td>
</tr>
<tr>
<td>63.</td>
<td>Wound Care Management</td>
<td>315</td>
</tr>
<tr>
<td>64.</td>
<td>Abdominal Trauma</td>
<td>319</td>
</tr>
<tr>
<td>65.</td>
<td>Thoracic Trauma</td>
<td>325</td>
</tr>
<tr>
<td>66.</td>
<td>Neurotrauma</td>
<td>331</td>
</tr>
<tr>
<td>67.</td>
<td>Blast Injuries</td>
<td>337</td>
</tr>
<tr>
<td>68.</td>
<td>Crush Injuries</td>
<td>341</td>
</tr>
<tr>
<td>69.</td>
<td>Missile Injuries</td>
<td>345</td>
</tr>
<tr>
<td>70.</td>
<td>Burn Management</td>
<td>349</td>
</tr>
<tr>
<td>V.</td>
<td>Pediatric Considerations and Disasters</td>
<td></td>
</tr>
<tr>
<td>71.</td>
<td>Pediatric Problems in Developing Countries</td>
<td>357</td>
</tr>
<tr>
<td>72.</td>
<td>Nutritional Assessment in Malnutrition</td>
<td>361</td>
</tr>
<tr>
<td>73.</td>
<td>Treatment of Malnutrition in Children</td>
<td>365</td>
</tr>
<tr>
<td>74.</td>
<td>Evaluation and Management of Pediatric Disaster Victims</td>
<td></td>
</tr>
<tr>
<td>75.</td>
<td>Pediatric-Specific Disaster-Related Considerations</td>
<td>375</td>
</tr>
<tr>
<td>76.</td>
<td>Pediatric Specialty Team Response to Disaster</td>
<td>381</td>
</tr>
<tr>
<td>VI.</td>
<td>Medical and Humanitarian Disasters</td>
<td></td>
</tr>
<tr>
<td>77.</td>
<td>Water, Sanitation, and Hygiene</td>
<td>389</td>
</tr>
<tr>
<td>78.</td>
<td>Shelter</td>
<td>393</td>
</tr>
<tr>
<td>79.</td>
<td>Refugees and Internally Displaced Populations</td>
<td>397</td>
</tr>
<tr>
<td>80.</td>
<td>Child Soldiers</td>
<td>401</td>
</tr>
<tr>
<td>81.</td>
<td>Reproductive Health</td>
<td>405</td>
</tr>
<tr>
<td>VII.</td>
<td>Education, Health Issues, and Resources</td>
<td></td>
</tr>
<tr>
<td>82.</td>
<td>Emergency Preparedness</td>
<td>411</td>
</tr>
<tr>
<td>83.</td>
<td>Syndromic Surveillance</td>
<td>417</td>
</tr>
<tr>
<td>84.</td>
<td>JCAHO Emergency Management Standards</td>
<td>425</td>
</tr>
<tr>
<td>85.</td>
<td>Health and the Humanitarian/Disaster Worker</td>
<td>431</td>
</tr>
<tr>
<td>86.</td>
<td>Immunization Schedules and Recommendations</td>
<td>435</td>
</tr>
<tr>
<td>87.</td>
<td>Healthcare Worker Exposures to Blood and Body Fluids</td>
<td>443</td>
</tr>
<tr>
<td>88.</td>
<td>Post-Traumatic Stress Disorder</td>
<td>449</td>
</tr>
<tr>
<td>89.</td>
<td>International Law: A Primer for Healthcare Professionals</td>
<td>455</td>
</tr>
<tr>
<td>90.</td>
<td>A Guide to the Worldwide Web</td>
<td>465</td>
</tr>
</tbody>
</table>

Index | 467 |