

Contents

1 Major Incidents: Definitions and Demands on the Health-Care System	1
1.1 Terminology	1
1.2 When, and by Whom, Is a "Major Incident" Declared?	2
1.3 The Risk for Major Incidents in the Modern Community.....	2
1.4 Demands on Health Care During Major Incidents.....	3
1.4.1 The Need for Planning and Preparedness.....	3
1.4.2 The Need for Education and Training	4
1.4.3 The Need for Development and Research	6
Further Reading	6
2 Major Incidents: Examples and Experiences.....	9
2.1 Terminology	9
2.2 Incidents That Occur as a Consequence of Technical Development.....	9
2.2.1 Transports	10
2.2.2 Accidents Caused by Hazardous Material.....	16
2.2.3 Accidents Caused by Radiation	18
2.2.4 Accidents Caused by Fire	19
2.2.5 Accidents During Public Gatherings	20
2.2.6 Collapse of Buildings and Constructions	21
2.3 Disturbances in Technical Systems	21
2.4 Intentionally Caused Incidents	22
2.4.1 Armed Conflicts.....	22
2.4.2 Terror Actions	22
2.5 Incidents Consequent to Changes in Nature and Climate	24
2.5.1 Sudden-Onset Incidents	24
2.5.2 Slow-Onset Incidents.....	31
2.6 Conclusions	31
References to Major Incidents and Disasters.....	31
3 The Prehospital Response	33
3.1 Structural Variations Between Countries	33
3.2 Terminology	33
3.3 First Unit on Scene.....	34
3.3.1 The First Report.....	34
3.3.2 Taking Command.....	34
3.3.3 Contact with the Rescue Incident Commander	34

3.3.4	Safety	35
3.3.5	Overview of the Scene.....	36
3.3.6	Second Report.....	37
3.3.7	Covering the Need for Medical Staff on Scene	37
3.3.8	Decision of Strategy for the Medical Work	37
3.3.9	Establishing Continuous Contact with the Regional Medical Command Center.....	38
3.3.10	Continued Coordination of the Medical Response on Scene	38
3.3.11	Major Incident Stand Down.....	38
3.4	Building Up the Structure on Scene Step by Step.....	38
3.4.1	The Need for Simplicity	38
3.4.2	The First Step: Starting Triage and Transport	39
3.4.3	The Second Step: Completing the Casualty and Ambulance Loading Zones	39
3.4.4	The Third Step: Completing the Organization on Scene	41
3.5	Equipment	43
3.5.1	Ambulance Equipment Vehicles.....	43
3.5.2	Special Equipment Supplied by the Rescue Service.....	43
3.6	Who Is Responsible for What?.....	45
3.6.1	Medical Staff on Scene	45
3.6.2	Military Staff.....	46
3.6.3	Voluntary Organizations	47
3.6.4	Voluntary Medical Staff.....	47
3.7	Triage on Scene	48
3.7.1	General Principles.....	48
3.7.2	Overview Before Starting Triage.....	48
3.7.3	Triage in Different Zones of the Scene.....	51
3.7.4	Indicating Priority	51
3.8	Treatment: How Much Should Be Done?	51
3.9	Transport of Casualties.....	53
3.9.1	Alert of Ambulances.....	53
3.9.2	Alert of Helicopters	53
3.9.3	Alert of Other Transport Facilities.....	54
3.9.4	Leading and Coordination of Transport.....	54
3.9.5	Ambulance Service.....	57
3.10	Registration on Scene.....	58
3.10.1	Medical Documentation.....	58
3.10.2	Identification and Destination.....	58
3.11	Communication	59
3.11.1	Problems and Limitations	59
3.11.2	The Telephone Net.....	59
3.11.3	The Mobile Telephone Net	59
3.11.4	The Radio Net.....	59
3.11.5	Other Communication Systems	60
3.12	Special Considerations in Terrorist Actions in Areas of Violence.....	60
	Further Reading	60

4 Triage	63
4.1 The Term Triage	63
4.2 Demands on Triage.....	63
4.2.1 Categories of Priority.....	64
4.2.2 Indication of Priority.....	64
4.3 Methodology of Triage.....	67
4.3.1 Anatomical Triage	67
4.3.2 Physiological Triage	67
4.3.3 Physiological Triage	68
4.3.4 Anatomical Triage	70
4.4 Outcome Related to Method of Triage.....	73
4.5 Triage in Children.....	74
4.5.1 Pediatric Triage Tape	74
Further Reading	74
5 The Hospital Response	77
5.1 The Need for Planning	77
5.2 The Disaster Plan: Goals and Structure.....	77
5.2.1 Demands on a Functioning Plan	77
5.2.2 The Need for Simplicity	78
5.2.3 Functions of Critical Importance for the Capacity of the Hospital	78
5.2.4 The Content of the Disaster Plan	78
5.2.5 What Every Staff Member Should Know	79
5.2.6 The “All Hazard” Concept.....	79
5.3 The Alert Process	79
5.3.1 Who Alerts?	79
5.3.2 Receiving the Alarm	80
5.3.3 Decision About the Level of Alert.....	80
5.3.4 Further Processing of the Alarm.....	81
5.3.5 Where to Go When Alerted	81
5.3.6 What to Do When Alerted	81
5.3.7 Canceling the Alert.....	81
5.4 Levels of Alert.....	81
5.4.1 Green Alert (“Stand by”)	81
5.4.2 Yellow Alert (“Partial Mobilization”).....	82
5.4.3 Red Alert (“Full Mobilization”)	82
5.4.4 The Need for Three Levels	82
5.5 Coordination and Command	83
5.5.1 Within the Hospital.....	83
5.5.2 Command on Regional Level	85
5.5.3 Command an National Level	85
5.6 Action Cards.....	87
5.7 Preparing the Hospital.....	88
5.8 Receiving Casualties	89
5.8.1 Primary Triage	89
5.8.2 Severely Injured Victims.....	89
5.8.3 Less Severely Injured Victims	92

5.8.4	Noninjured Victims.....	92
5.8.5	Dead Victims	92
5.9	Continued Treatment of Injured Patients	92
5.9.1	Patients Who Need Immediate Surgery and/or Intensive Care	92
5.9.2	Patients Needing In-Patient Care	93
5.10	Registration of Patients.....	93
5.11	Hospital Information Center.....	93
5.12	Management of Media.....	94
5.13	Supplies	95
5.14	Technical Functions.....	95
5.14.1	Electrical Power	95
5.14.2	Water	96
5.14.3	Computer Support.....	96
5.15	Communication	96
5.16	Psychosocial Support	96
5.17	Incidents Primarily Involving the Hospital	97
5.18	Special Types of Incidents.....	97
5.19	The Recovery Phase	97
	Further Reading	98
6	Management and Identification of Dead Victims.....	99
6.1	Introduction	99
6.2	Care of the Deceased on the Scene	99
6.2.1	Packing, Labeling, and Transport	99
6.2.2	Preliminary Storage	99
6.2.3	Delivery and Funeral.....	100
6.2.4	Local Instructions	100
6.3	Identification of the Deceased Under Normal Conditions	100
6.4	Identification During Major Incidents with Many Deceased	100
6.4.1	Final Identification.....	101
6.4.2	Identification Teams.....	101
6.4.3	Methods for Identification of the Deceased.....	101
6.4.4	Forensic Autopsy	102
6.4.5	DNA Investigations.....	103
6.5	International DVI Work.....	106
	Further Reading	110
7	Incidents Caused by Physical Trauma	111
7.1	Different Mechanisms of Injury in Different Kinds of Incidents	111
7.2	Effects of Different Kinds of Physical Trauma	111
7.3	Penetrating Injuries.....	112
7.3.1	Wounds Involving Skin and Subcutaneous Tissues.....	112
7.3.2	Missile and Fragment Injuries	113
7.3.3	Other Wounds Penetrating into Body Cavities	115
7.4	Nonpenetrating Injuries.....	115
7.4.1	Blunt Trauma	116
7.4.2	Blast Injury	116
7.4.3	Crush Injury	117

7.5	Primary Management of the Injured	118
7.5.1	The Importance of Time	118
7.5.2	The Importance of a Standardized Methodology	118
7.5.3	Action Plan for Primary Management	119
7.5.4	Primary Survey with Elimination of Threats Against Vital Functions	119
7.6	Triage on Scene	135
7.7	Decision with Regard to Continued Prehospital Treatment	136
7.8	Prehospital Fluid Resuscitation	136
7.8.1	Vascular Access	136
7.8.2	Different Kinds of Fluids: Advantages and Disadvantages	137
7.8.3	Recommended Guidelines for Use in Major Incidents	137
7.9	Prehospital Pain Relief	138
7.10	Prehospital Stabilization of Limb Injuries	139
7.10.1	The Importance of Accurate Stabilization Before Transport	139
7.10.2	Open Fractures	139
7.10.3	Closed Fractures and Dislocations	139
7.11	Priority for Transport	144
7.12	Transport	144
7.13	Primary Triage and Management in the Hospital	144
7.13.1	Primary Triage at the Hospital Entrance	144
7.13.2	Major Incident Resuscitation Teams	145
7.13.3	Primary Management of Severely Injured Patients	146
7.13.4	Additional Investigations	148
7.14	Continued Treatment in the Hospital	148
7.15	Damage Control	149
7.15.1	Indications for Damage Control	150
7.15.2	Results of Damage Control	150
7.16	Injuries to Different Organ Systems	151
7.16.1	Head Injuries	151
7.16.2	Maxillofacial Injuries	153
7.16.3	Eye Injuries	156
7.16.4	Injuries to the Ears	157
7.16.5	Injuries to the Neck	157
7.16.6	Chest Injuries	160
7.16.7	Abdominal Injuries	163
7.16.8	Injuries to the Urinary Tract	175
7.16.9	Pelvic Injuries	175
7.16.10	Spinal Injuries	178
7.16.11	Limb Injuries	179
7.17	Special Injuries Commonly Occurring in Major Incidents	183
7.17.1	Missile and Fragment Injuries	183
7.17.2	Amputations	186
7.17.3	Crush Injury and Compartment Syndrome	187
7.17.4	Blast Injury	189
7.17.5	Special Categories of Injured	191
	Further Reading	192

8 Incidents Caused by Fire and Toxic Gas	197
8.1 Treatment Strategies for Burns.....	197
8.1.1 Extent of Injury.....	197
8.1.2 Surface Area.....	198
8.1.3 Burn Wound Depth.....	199
8.1.4 Fluid Treatment.....	199
8.1.5 Inhalation Injuries and Facial Burns.....	200
8.2 Modern Treatment Strategy.....	201
8.2.1 Acute Burn Life Support.....	202
8.2.2 Modern Burn Treatment: The Three Phases.....	202
8.3 Burn Care During Major Incidents.....	204
8.3.1 Care Level A.....	205
8.3.2 Care Level B.....	207
8.3.3 Care Level C.....	208
8.3.4 Transport of Patients.....	208
8.4 National and International Burn Care Societies.....	209
Further Reading.....	209
9 Incidents in Cold and Wet Environments	211
9.1 Hypothermia.....	211
9.1.1 Effects of Cooling.....	211
9.1.2 Predisposing Factors of Hypothermia.....	212
9.1.3 Effects on Different Organ Systems.....	212
9.1.4 Clinical Signs and Symptoms.....	213
9.1.5 Protection from Further Cooling.....	215
9.1.6 Positioning, Evacuation, and Transport.....	216
9.1.7 Triage.....	216
9.1.8 Criteria to Declare Death.....	217
9.1.9 In-hospital Management.....	217
9.2 Results of Treatment of Hypothermia.....	220
9.3 Cold Injuries.....	220
9.3.1 Risk for Cold Injuries in Traumatized Patients.....	220
9.4 Avalanche Incidents.....	224
9.5 Drowning.....	225
9.5.1 Definitions.....	225
Further Reading.....	226
10 Incidents Caused by Hazardous Material	229
10.1 Introduction.....	229
10.2 The Prehospital Response.....	231
10.2.1 Activities En Route to the Incident Site.....	231
10.2.2 Arrival at the Incident Site.....	231
10.2.3 Treatment of Victims.....	233
10.2.4 Transportation of Victims.....	236
10.2.5 Management of Fatalities.....	237
10.3 The Hospital Response.....	237
10.3.1 The Alert Process.....	237
10.3.2 Coordination and Command.....	237
10.3.3 Preparing the Hospital.....	237
10.3.4 Receiving Casualties.....	238

10.4 Personal Protective Equipment and Training	240
10.4.1 Recommendations.....	241
10.5 Decontamination and Decontamination Triage.....	242
10.5.1 Decontamination of Children	244
10.5.2 Decontamination Triage	244
10.5.3 Nonambulatory Victims.....	244
10.6 Role of the PCC in Chemical Incidents	246
10.6.1 Operational Activities of the PCC in a Chemical Incident Response.....	246
10.6.2 Monitoring Possible Delayed Effects	246
10.6.3 Cooperation When Preparing Rescue Management Plans.....	246
10.6.4 Laying Down Recommended Procedures and Guidelines for the Response to Chemical Incidents	247
10.6.5 Rational Antidote Supply	247
10.6.6 Providing Training for Medical Personnel and Other Rescue Workers Assigned to Respond to Chemical Incidents	247
10.6.7 Cooperating in Preparing Analyses and Follow-Up Studies of Chemical Accidents and Proposing Improvements	247
10.7 General Approach to Toxic Trauma Treatment.....	247
10.7.1 Identifying the Name of Chemicals and Hazard Recognition	248
10.7.2 Exposure, Poisoning	249
10.7.3 Toxicokinetics, Toxicodynamics.....	250
10.7.4 Toxicologic Sample Analysis	250
10.7.5 Documentation.....	250
10.8 Antidotes	251
10.8.1 Antidote Within the Poisoning Treatment Scheme.....	251
10.8.2 Contraindications for Antidote Administration	251
10.8.3 Antidotes for Use in Chemical Incidents	252
10.9 Toxic Trauma Treatment of the Most Common Toxic Injuries.....	255
10.9.1 Irritant Gases (Irritants)	255
10.9.2 Asphyxiants	258
10.9.3 Organic Solvents.....	261
10.9.4 Acetyl Cholinesterase Inhibitors (Nerve Agents).....	264
10.9.5 Blister Agents (Vesicants).....	267
10.9.6 Chemicals Used for Temporary Incapacitation (Lachrymators).....	272
Further Reading	274
11 Incidents Caused by Irradiation.....	275
11.1 Different Types of Incidents.....	275
11.2 Examples of Incidents with Release of Radioactive Material	275
11.2.1 Reactor Breakdowns	275
11.2.2 Accidents with Lost or Unknown Irradiation Sources.....	277
11.2.3 Accidents in Nuclear Industry	277

11.2.4 International Spread of Radioactive Material and Use of Nuclear Reactions.....	278
11.3 Basic Radiation Physics	279
11.3.1 Different Types of Ionizing Radiation	279
11.3.2 Natural and Artificial Ionizing Radiation	280
11.3.3 Dose and Activity	280
11.3.4 External and Internal Radiation	280
11.3.5 External and Internal Contamination.....	281
11.4 The Effects of Ionizing Radiation	281
11.4.1 Biological Effects of Ionizing Radiation	281
11.4.2 Medical Effects of Ionizing Radiation.....	281
11.4.3 Acute (Deterministic) Radiation Injuries.....	281
11.4.4 Stochastic Effects of Radiation.....	283
11.4.5 Prenatal Exposure Effects.....	283
11.5 Medical Response to Nuclear and Radiological Incidents.....	284
11.5.1 Planning and Organization.....	284
11.5.2 Risk Zones	285
11.5.3 Decontamination.....	285
11.5.4 Triage	286
11.5.5 Diagnosis	286
11.6 Treatment.....	287
11.6.1 Treatment of Whole-Body Radiation	287
11.6.2 Treatment of Internal Contamination	288
11.6.3 Initial Treatment of Internal Contamination	288
11.6.4 Specific Treatments: Blocking, Dilution, and Displacement Agents	288
11.6.5 Chelating Agents	289
11.6.6 General Recommendations for the Treatment of Internal Contamination (TIARA, EC).....	289
11.6.7 Surgical Treatment.....	289
11.6.8 Psychological Aspects and the Necessity of Information	290
11.7 Planning and Preparedness.....	290
11.7.1 Local Level	291
11.7.2 Regional Level	291
11.7.3 National Level.....	291
11.7.4 International Level	291
11.8 Global International Organizations	291
Further Reading	292
12 Infectious Diseases and Microbiological Threats.....	293
12.1 Introduction	293
12.2 Classification of Microbiological Incidents	294
12.2.1 Incidents Consequent to Technical Development.....	294
12.2.2 Incidents Intentionally Caused by Man	295
12.2.3 Incidents Consequent to Changes in Climate and Nature.....	296
12.3 Terminology and Characteristics of Infectious Disease Incidents.....	296

12.4 Routes of Transmission for Communicable Diseases	298
12.4.1 Infection Control and Personal Protection	299
12.5 Personal Protection Through Medical Interventions	301
12.6 Bioterrorism	302
12.6.1 When to Suspect an Intentionally Caused Incident?	302
12.7 Conclusions	303
Further Reading	303
13 Incidents Caused by Changes in Nature and Climate	305
13.1 Introduction	305
13.2 Epidemiology of Natural Disasters	305
13.3 The Short- and Long-Term Consequences of Natural Disasters	305
13.4 Vulnerability and the Ability to Recover	
Varies Between Communities	307
13.5 Seismic Natural Disasters	308
13.5.1 Earthquakes	308
13.5.2 Tidal Waves (Tsunamis)	309
13.6 Meteorological Natural Disasters	309
13.6.1 High Wind Speeds	309
13.6.2 Floods	311
13.6.3 Extreme Temperature Conditions	311
13.7 Natural Disasters Indirectly Caused by Environmental Impact	311
13.8 National and International Disaster Medicine	311
13.9 Needs Assessment	312
13.10 Local and National Relief Operations	313
13.11 International Humanitarian Relief	313
13.12 Vital Relief Needs	315
13.13 The Earthquake and Tsunami in Japan, March 11, 2011	317
Further Reading	318
14 Combat Casualty Management	321
14.1 Definition	321
14.2 Combat Casualty Care Approach	322
14.2.1 Level 1	322
14.2.2 Level 2	325
14.2.3 Evacuation to Levels 3, 4, and 5	326
14.2.4 Additional Trauma Management Issues	328
14.2.5 The CNN Effect	329
14.3 Civilian Application of C3 Principles for Major Incidents	329
14.4 Conclusions	333
Further Reading	334
15 Terrorist Attacks on the Civilian Community	337
15.1 Introduction	337
15.2 The Strategy of Terrorism	337
15.2.1 The Structure of Terrorist Organisations	338
15.2.2 Stages of Terrorist Activity	339
15.2.3 Techniques, Tactics, and Procedures of Terrorists	339
15.3 Terror Medicine	342

15.4 Impact of Terrorism on the Prehospital Organization	343
15.4.1 Police	343
15.4.2 Fire Brigade/Rescue Service.....	345
15.4.3 Ambulance/Medics	346
15.4.4 Military	347
15.5 The Hospital Response to Terrorist Incidents	347
15.5.1 Importance of the Planning Process	348
15.6 Impact of Terrorism on Hospitals.....	348
15.6.1 Security of the Hospital	349
15.6.2 Security of the Patients	349
15.6.3 Security of Ambulance Vehicles Parked at the Entrances.....	349
15.6.4 Issues Regarding Ethnic Groups Within the Hospital.....	349
15.6.5 Issues with Telephone Communication	349
15.6.6 Impact of Police and Security Services	349
15.6.7 Issues with the Media	350
15.6.8 Issues with Foreign Embassies	350
15.6.9 VIP Visits.....	350
15.7 Conclusions	350
Further Reading	351
16 Scoring Systems Related to Outcome in Severe Injuries.....	353
16.1 Anatomical Scoring Systems	353
16.1.1 Abbreviated Injury Scale	353
16.1.2 Injury Severity Score	354
16.1.3 Anatomical Profile	354
16.1.4 New Injury Severity Score (NISS).....	355
16.1.5 ICISS (ICD-9 Injury Severity Score).....	355
16.2 Physiological Scoring Systems	355
16.2.1 Revised Trauma Score (RTS)	355
16.2.2 Triage Revised Trauma Score (T-RTS).....	356
16.3 Combined Scoring Systems	356
16.3.1 The Probability of Death Score	356
16.3.2 TRISS (Trauma Score, Injury Severity Score)	356
16.3.3 A Severity Characterization of Trauma (ASCOT).....	357
16.3.4 Polytrauma Score.....	357
16.3.5 Base Excess Injury Severity Scale (BISS).....	357
16.3.6 Pediatric Trauma Score.....	358
16.3.7 Other Combined Systems	358
16.4 Outcome	358
16.4.1 Survival.....	358
16.4.2 Long-Term Outcome and Consequences of Injuries	358
16.4.3 Organ-Related Outcome Scores.....	359
16.4.4 Universal Outcome Scales	359
16.4.5 Psychologic Outcome	360
16.4.6 Problems and Pitfalls	360
16.4.7 Summary and Conclusions	360
References.....	361

17 Psychological Crisis Support in Major Incidents	363
17.1 Introduction	363
17.2 Historical Background.....	363
17.3 Crisis Support: Background	364
17.3.1 Holistic View	364
17.3.2 Major incidents	364
17.3.3 Survivors	364
17.3.4 Relatives and Friends.....	365
17.4 Stress Reactions After Major Incidents.....	365
17.4.1 What Do We Mean by Reactions After Traumatic Stress?	365
17.4.2 How to Recognize Traumatic Stress Reactions	366
17.5 More Severe Symptoms	366
17.6 Posttraumatic Stress Disorder	367
17.6.1 Risk Factors for Posttraumatic Stress Reactions	368
17.6.2 Resilience.....	368
17.6.3 Trajectories	368
17.7 Crisis Support.....	369
17.7.1 On Site	369
17.8 Psychological First Aid	369
17.8.1 Contact and Engagement	369
17.8.2 Sense of Safety and Comfort	370
17.8.3 Calming and Stabilizing	370
17.8.4 Positive Coping.....	371
17.8.5 Connectedness and Social Support.....	371
17.8.6 Hope.....	371
17.8.7 Follow-Up.....	372
17.8.8 When Do Survivors Need More Extended Support?.....	372
17.8.9 Support for Special Groups	372
17.8.10 Cultural and Religious Diversity	373
17.8.11 Rites and Customs	374
17.8.12 Seeing Deceased Loved Ones	374
17.9 Treatment.....	374
17.9.1 Psychological Treatment.....	374
17.9.2 Pharmacological Treatment	375
17.10 Self-Care.....	375
17.10.1 Taking Care of Oneself.....	376
Further Reading	376
18 Education and Training.....	379
18.1 The Need for Education and Training	379
18.2 Education on Different Levels.....	379
18.2.1 Basic Education	380
18.2.2 Specialist Training	380
18.2.3 Postgraduate Training	381
18.2.4 Repeated Training	381
18.3 Methodology of Training	381
18.3.1 Problems with Training and How to Cope with Them.....	381

18.3.2 Demands on Training in Decision Making, the Keystone of Major Incident Response	382
18.3.3 Validation of Educational Models	382
18.4 Models for Interactive Training.....	383
18.4.1 Practical Field Exercises.....	383
18.4.2 Table Top Exercises	385
18.5 Course Models.....	389
18.5.1 Undergraduate Training.....	389
18.5.2 Specialist Training	390
18.5.3 Postgraduate Training	390
18.6 Who Should Deliver the Training?.....	393
Further Reading	397
19 Further Methodological Development and Research	399
19.1 The Science of Disaster Medicine.....	399
19.2 Historical Background.....	399
19.3 The Need for Research	400
19.3.1 Research Covering the Whole Field of Major Incident Response.....	401
19.3.2 Research Within Specialties Involved in Major Incident Response	403
19.4 Future Perspectives.....	405
Further Reading	405
Index.....	407