Eleventh Edition

Prehospital Emergency Care

Joseph J. Mistovich | Keith J. Karren

Medical Editor Howard A. Werman, MD

Brief Contents

PART 1

Preparatory and Public Health 1

1 Emergency Medical Care Systems, Research, and Public Health 1
2 Workforce Safety and Wellness of the EMT 19
3 Medical, Legal, and Ethical Issues 45
4 Documentation 63
5 Communication 81
6 Lifting and Moving Patients 101

PART 2

Anatomy, Physiology, and Medical Terminology 127

7 Anatomy, Physiology, and Medical Terminology 127

PART 3

Pathophysiology 177

8 Pathophysiology 177

PART 4

Life Span Development 204

9 Life Span Development 204

PART 5

Airway Management, Artificial Ventilation, and Oxygenation 216

10 Airway Management, Artificial Ventilation, and Oxygenation 216

PART 6

Assessment 284

11 Vital Signs, Monitoring Devices, and History Taking 286
12 Scene Size-Up 314
13 Patient Assessment 333

PART 7

General Pharmacology and Medication Administration 419

14 General Pharmacology and Medication Administration 419

PART 8

Shock and Resuscitation 435

15 Shock and Resuscitation 435

PART 9

Medical 472

16 Respiratory Emergencies 472
17 Cardiovascular Emergencies 520
18 Altered Mental Status, Stroke, and Headache 555
19 Seizures and Syncope 584
20 Acute Diabetic Emergencies 603
21 Allergic and Anaphylactic Reactions 629
22 Toxicologic Emergencies 650
23 Abdominal, Hematologic, Gynecologic, Genitourinary, and Renal Emergencies 696
24 Environmental Emergencies 728
25 Submersion Incidents: Drowning and Diving Emergencies 768
26 Psychiatric Emergencies 785

PART 10

Trauma 810

27 Trauma Overview: The Trauma Patient and the Trauma System 810
28 Bleeding and Soft Tissue Trauma 833
29 Burns 873
30 Musculoskeletal Trauma and Nontraumatic Fractures 896
31 Head Trauma 927
32 Spinal Injury and Spine Motion Restriction 947
33 Eye, Face, and Neck Trauma 998
34 Chest Trauma 1020
35 Abdominal and Genitourinary Trauma 1041
36 Multisystem Trauma and Trauma in Special Patient Populations 1053

PART 11

Special Patient Populations 1066

37 Obstetrics and Care of the Newborn 1066
38 Pediatrics 1116
39 Geriatrics 1181
40 Patients with Special Challenges 1209
41 The Combat Veteran 1244

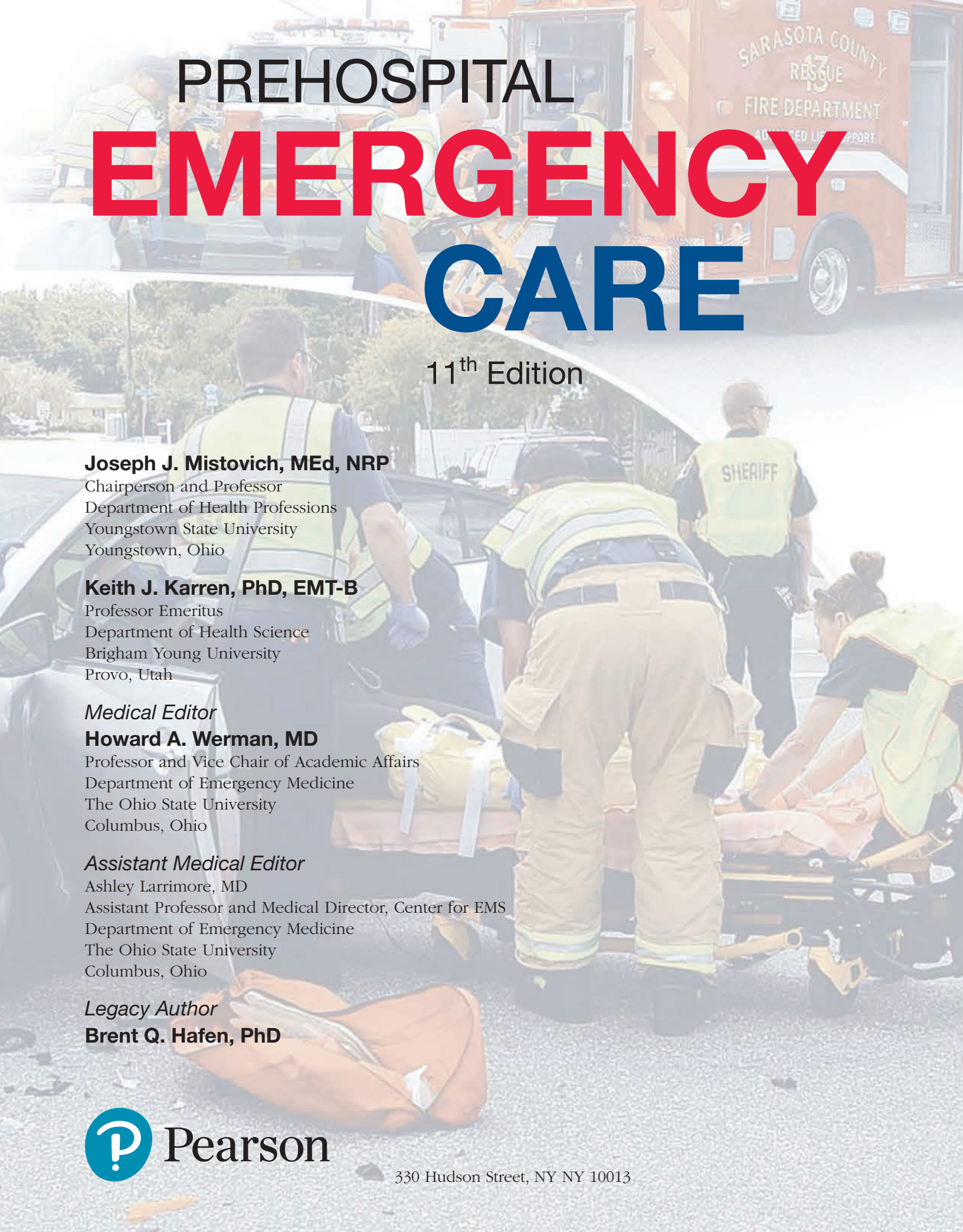
PART 12

EMS Operations 1255

42 Ambulance Operations and Air Medical Response 1255
43 Gaining Access and Patient Extrication 1282
44 Hazardous Materials 1300
45 Multiple-Casualty Incidents and Incident Management 1322
46 EMS Response to Terrorist Incidents 1340

Appendix 1 ALS-Assist Skills 1359
Appendix 2 Advanced Airway Management 1366
Appendix 3 Agricultural and Industrial Emergencies 1398

Answer Key 1407
Glossary 1445
Index 1461



PREHOSPITAL EMERGENCY CARE

11th Edition

Joseph J. Mistovich, MEd, NRP
Chairperson and Professor
Department of Health Professions
Youngstown State University
Youngstown, Ohio

Keith J. Karren, PhD, EMT-B
Professor Emeritus
Department of Health Science
Brigham Young University
Provo, Utah

Medical Editor
Howard A. Werman, MD
Professor and Vice Chair of Academic Affairs
Department of Emergency Medicine
The Ohio State University
Columbus, Ohio

Assistant Medical Editor
Ashley Larrimore, MD
Assistant Professor and Medical Director, Center for EMS
Department of Emergency Medicine
The Ohio State University
Columbus, Ohio

Legacy Author
Brent Q. Hafen, PhD

Pearson

330 Hudson Street, NY NY 10013

Library of Congress Cataloging-in-Publication Data
Names: Mistovich, Joseph J., author. | Karren, Keith J., author. | Werman, Howard A., editor. | Hafen, Brent Q.
Title: Prehospital emergency care / Joseph J. Mistovich, Keith J. Karren; medical editor, Howard A. Werman; legacy author, Brent Q. Hafen.
Description: 11th edition. | Hoboken, New Jersey: Pearson Education, Inc., 2018.
Identifiers: LCCN 2017041162| ISBN 9780134704456 | ISBN 0134704452
Subjects: | MESH: Emergency Treatment--methods | Emergency Medical Services | Emergencies | Emergency Medical Technicians
Classification: LCC RC86.7 | NLM WB 105 | DDC 616.02/5--dc23
LC record
available at https://lccn.loc.gov/2017041162

Vice President, Health Science and TED: Julie Levin Alexander
Director of Portfolio Management: Marlene McHugh Pratt
Portfolio Manager: Derril Trakalo
Development Editor: Sandra Breuer
Portfolio Management Assistant: Lisa Narine
Vice President, Content Production and Digital Studio: Paul DeLuca
Managing Producer, Health Science: Melissa Bashe
Content Producer: Faye Gemmellaro
Project Monitor: Ana Diaz-Caneja, SPi Global
Operations Specialist: Mary Ann Gloriande
Creative Director: Blair Brown
Creative Digital Lead: Mary Siener
Director, Digital Production: Amy Peltier
Digital Studio Producer, REVEL and e-text 2.0: Ellen Viganola, Allison Longley
Digital Content Team Lead: Brian Prybella
Digital Content Project Lead: Christian Lee
Vice President, Product Marketing: David Gesell
Field Marketing Manager: Brian Hoehl
Full-Service Project Management and Composition: SPi Global
Project Manager: Patty Donovan, SPi Global
Inventory Manager: Vatche Demirdjian
Managing Photography Editor: Michal Heron
Photographers: Michal Heron, Maria Lyle, Kevin Link, Ed Effron
Interior Design: Studio Montage
Cover Design: Studio Montage
Cover Images: © Ed Effron
Printer/Binder: LSC Communications, Inc.
Cover Printer: Phoenix Color/Hagerstown

Credits and acknowledgments borrowed from other sources and reproduced, with permission, in this textbook appear on the appropriate pages within the text.
Part Operner Photos: 1 © Ed Effron; 2 Lightspring/Shutterstock; 3 Phonlamai Photo/Shutterstock; 4 Monkey Business Images/Shutterstock; 5 Michal Heron/Pearson Education, Inc.; 6 © Ed Effron; 7 Grycaj/Shutterstock; 8-11 Michal Heron/Pearson Education, Inc.; 12 Edward T. Dickinson, MD

10 9 8 7 6 5 4 3 2

ISBN 13: 978-0-13-470445-6
ISBN 10: 0-13-470445-2

Dedication

To my best friend and beautiful wife, Andrea, for her unconditional love and inspiration to pursue my dreams. To my daughters Katie, Kristyn, Chelsea, Morgan, and Kara, who are my never-ending sources of love, laughter, and adventure and remind me why life is so precious. I love you all! In memory of my father, Paul, who was a continuous source of encouragement and the epitome of perseverance. I have come to realize that he is my hero.

To Bill Brown, my EMS instructor, mentor, colleague, and most importantly my friend, an exemplary EMS educator, professional, and visionary, who instilled in me the meaning of commitment and a belief in excellence in emergency medical services.

To Captain James Woodward and Specialist Joseph Buday (veteran of Operation Iraqi Freedom), who are currently serving in the U.S. Army; Vietnam combat veterans Raymond Courtney, William E. Brown, Jr., and James D. Lange; and all current military personnel and veterans, but especially combat veterans of foreign wars and conflicts who unselfishly served their country with duty and honor.

JJM

To my eternal sweetheart Diane, for her continual inspiration and support. Any success that I have enjoyed has been fueled by our relationship.

To the greatest children a father could be blessed with: Michael Scott, Holli, James, Brady, and Mandy, who grew up with EMS activity.

Lastly, to the new generation who are being EMS-educated in preparation for service to their communities across this great land—specifically my grandchildren Joshua Keith, Kennedi, Jackson David, Madilyn, Shelby, Little Scott, Brigham, Nixon, Brynlee, and McKenzie.

KJK

Detailed Contents

Key Features xvii
EMT Skills xix
Preface xxi
What's New in the 11th Edition? xxiii
Acknowledgments xxvii
About the Authors xxix

PART 1

Preparatory and Public Health 1

1 Emergency Medical Care Systems, Research, and Public Health 1
Introduction 2
The Emergency Medical Services System 2
A Brief History 2
Technical Assistance Program Assessment Standards 3
The EMT 7
Roles and Responsibilities 7
Professional Attributes 9
Ems System Organization and Standards 11
State EMS Agency Role 11
Medical Oversight of EMS 11
Quality Improvement 12
Patient Safety 13
EMS Research 13
Evidence-Based Guidelines 14
Public Health 15
Mobile Integrated Healthcare and Community Paramedicine 16

2 Workforce Safety and Wellness of the EMT 19
Introduction 20
Emotional Aspects of Emergency Care 20
Death and Dying 20
High-Stress Situations 21
Stress Reactions 22
Stress Management 23
Critical Incident Stress Management 25
Scene Safety 25
Protecting Yourself from Disease 25
Infectious Diseases of Concern to the EMT 31
Protecting Yourself from Accidental and Work-Related Injury 34
Wellness Principles 38
Physical Well-Being 38
Mental Well-Being 40

3 Medical, Legal, and Ethical Issues 45
Introduction 46
The Scope of Practice 46
Legal Duties 46
Ethical Responsibilities 48
Issues of Patient Consent and Refusal 48
Types of Consent 48
Advance Directives 49
Refusing Treatment 52
Other Legal Aspects of Emergency Care 54
Negligence 54
Intentional Tort 55
Confidentiality 56
Health Insurance Portability and Accountability Act 56
COBRA and EMTALA 57
Protecting Yourself in Transport and Transfer Situations 57
Special Situations 57

4 Documentation 63
Introduction 64
Functions of the Prehospital Care Report 64
Continuity of Medical Care 65
Administrative Uses 65
Legal Document 65
Educational and Research Uses 65
Evaluation and Continuous Quality Improvement 65
Collection of Data in Prehospital Care Reports 65
PCR Formats 66
PCR Data 68
Medical Abbreviations 70
Legal Concerns 74
Confidentiality 74
Distribution 74
Refusal of Treatment 74
Falsification 75
Transfer-of-Care Report 76
Multiple-Casualty Incidents 76
Special Reports 77
Alternative Documentation Methods 77
SOAP 77
CHART 77
CHEATED 78

5 Communication 81
Introduction 82
EMS Communications Systems 83
Components of an Emergency Communications System 83
Communicating within the System 86
Ground Rules for Radio Communication 87
Phone/Cellular Phone Communication 88
Communicating with Dispatch 88
Communicating with Health Care Professionals 89
Team Communication and Dynamics 91
Taking Charge 91
Radio Codes 91
Times 91
Radio Terms 91
Therapeutic Communication 92
Principles of Patient Communication 92
The Communication Process 92
Communication Responses 92
Communicating with the Patient 93
Patient Contact 93
The Patient Interview 94
Nonverbal Communication 94
Asking Questions 95
Considerations in Interviewing 96
Special Circumstances 97

6 Lifting and Moving Patients 101
Introduction 102
Body Mechanics for Safe Lifting 102
Four Basic Principles 102
Posture and Fitness 103
Communication and Teamwork 103
General Guidelines for Lifting and Moving 104
The Power Lift 104
The Squat Lift 105
One-Handed Equipment-Carrying Technique 105
Reaching 105
Pushing and Pulling 106
Lifting and Moving Patients 106
Emergency Moves 107
Urgent Moves 108
Nonurgent Moves 109
Packaging for Transportation 110
Equipment 110
Patient Positioning 116
Packaging Patients for Air Transport 117
General Guidelines for Carrying a Patient using a Backboard, Portable Stretcher, or Flexible Stretcher 117
Two-Person Carry 118
Four-Person Carry 118
Carrying a Supine Patient on Stairs 118
Neonatal Isolette 118

PART 2
Anatomy, Physiology, and Medical Terminology 127

7 Anatomy, Physiology, and Medical Terminology 127
Introduction 129
Anatomical Terms 129
Body Systems 132
The Musculoskeletal System 132
The Respiratory System 141
The Circulatory System 150
The Endocrine System 160
The Integumentary System (Skin) 162
The Digestive System 163
The Urinary or Renal System 165
The Reproductive System 165
Medical Terminology 165
Medical Words and Word Parts 165

PART 3
Pathophysiology 177

8 Pathophysiology 177
Introduction 178
Cellular Metabolism 178
Aerobic Metabolism 178
Anaerobic Metabolism 179
Components Necessary for Adequate Perfusion 180
Composition of Ambient Air 181
Patency of the Airway 182
Respiratory Compromise Associated with Mechanics of Ventilation 183
Regulation of Ventilation 187
Ventilation/Perfusion Ratio 189
Transport of Oxygen and Carbon Dioxide by the Blood 192
Blood Volume 193
Pump Function of the Myocardium 194
Systemic Vascular Resistance (SVR) 196
Microcirculation 198
Blood Pressure 199

PART 4

Life Span Development 204

9 Life Span Development 204

Introduction 205

Life Span Development 205

- Neonates and Infants 205
- Toddlers and Preschool-Age Children 208
- School-Age Children 209
- Adolescence 210
- Early Adulthood 211
- Middle Adulthood 211
- Late Adulthood 212

PART 5

Airway Management, Artificial Ventilation, and Oxygenation 216

10 Airway Management, Artificial Ventilation, and Oxygenation 216

Introduction 218

Respiration 218

Respiratory System Review 218

- Anatomy of the Respiratory System 219
- Mechanics of Ventilation (Pulmonary Ventilation) Review 221
- Respiratory Physiology Review 223
- Pathophysiology of Pulmonary Ventilation and External and Internal Respiration 225
- Airway Anatomy in Infants and Children 226

Airway Assessment 227

- Airway Functions and Considerations 228
- Abnormal Upper Airway Sounds 228
- Opening the Mouth 229
- Opening the Airway 229
- Suctioning 233
- Airway Adjuncts 235

Assessment of Breathing 239

- Relationship of Volume and Rate in Breathing Assessment 239

Assessing for Adequate Breathing 240

- Adequate Breathing 242
- Inadequate Breathing 243

Deciding whether or not to Assist Ventilation 244

Techniques of Artificial Ventilation 245

- Differences Between Normal Spontaneous Ventilation and Positive Pressure Ventilation 245
- Basic Considerations 246
- Mouth-to-Mouth Ventilation 249
- Mouth-to-Mask and Bag-Valve Ventilation: General Considerations 249
- Mouth-to-Mask Ventilation 251
- Bag-Valve-Mask Ventilation 253
- Flow-Restricted, Oxygen-Powered Ventilation Device (FROPVD) 257
- Automatic Transport Ventilator (ATV) 258
- Ventilation of the Patient Who Is Breathing Spontaneously 259
- Continuous Positive Airway Pressure (CPAP) 260
- Hazards of Overventilation 263

Special Considerations in Airway Management and Ventilation 263

- A Patient with a Stoma or Tracheostomy Tube 263
- Infants and Children 265
- Patients with Facial Injuries 265
- Foreign Body Airway Obstruction 266
- Dental Appliances 266

Oxygen Therapy 266

- Oxygen Cylinders 266
- Safety Precautions 267
- Pressure Regulators 267
- Oxygen Humidifiers 268
- Clinical Decision Making Regarding Oxygen Administration 268
- Indications for Oxygen Administration 269
- Variations in SpO_2 Goals for Medical, Trauma, and Other Special Consideration Patients 269
- Hazards of Oxygen Administration 270
- Oxygen Administration Procedures 270
- Terminating Oxygen Therapy 270
- Transferring the Oxygen Source: Portable to On-Board 271
- Oxygen Delivery Equipment 271

PART 6

Assessment 284

11 Vital Signs, Monitoring Devices, and History Taking 286

Introduction 287

- Gathering Patient Information 287

Vital Signs 288

- Respiration 288
- Pulse 290
- Skin 293
- Pupils 294
- Blood Pressure 296
- Testing Orthostatic Vital Signs 299
- Vital Sign Reassessment 299

Monitoring Equipment 299

- Pulse Oximeter: Oxygen Saturation Assessment 299
- Noninvasive Blood Pressure Monitor 301
- Capnometry ($EtCO_2$ Monitor) 302

Preparing to take the History 303

- Gain Control of the Scene 303
- Achieve a Smooth Transition of Care 303

Reduce the Patient's Anxiety 303
Maintain Control 304
Taking the History 305
Statistical and Demographic Information 305
Current Health Status 305
Techniques for Taking a Patient History 305
Standardized Approach to History Taking 306
Sensitive Topics or Special Challenges 308

12 Scene Size-Up 314
Introduction 315
Violence toward EMS Personnel 316
Take the Necessary Standard Precautions and other Personal Protection Precautions 316
Determine Scene Safety 317
Consider Dispatch Information 317
Consider the Need for Additional or Specialized Resources 318
Consider Scene Characteristics 318
Protect the Patient 324
Protect Bystanders 325
Control the Scene 325
Maintain Situation Awareness 326
Determine the Nature of the Problem 326
Determine the Mechanism of Injury 326
Determine the Nature of the Illness 328
Determine the Number of Patients 329

13 Patient Assessment 333
Introduction 335
Form a General Impression of the Patient 336
Introduction to Spine Motion Restriction 338
Determine Whether the Patient Is Injured or Ill 339
Obtain the Chief Complaint 340
Identify Immediate Life Threats During the General Impression 341
Perform Spine Motion Restriction 341
Position the Patient for Assessment 342
Assess Level of Consciousness (Mental Status) 342
Assess the Level of Responsiveness 342
Assess the Airway 345
Determine Airway Status 345
Open the Airway 345
Assess Breathing 346
Assess Rate and Quality of Breathing 347
Assess Oxygenation 349
Oxygen Therapy in the Patient with Adequate Breathing 349
Assess Circulation 349
Assess the Pulse 350
Identify Major Bleeding 351
Assess Perfusion 351
Establish Patient Priorities 353
Overview of Secondary Assessment: Anatomic and Body Systems Approaches, Vital Signs, and History 357
Performing the Secondary Assessment: An Anatomic Approach 357
Performing the Secondary Assessment: A Body Systems Approach 366
Assess Vital Signs 367
Obtain a History 367
Reevaluate the Mechanism and Injury 368
Significant Mechanisms of Injury 368
Rapid Secondary Assessment: Trauma Patient with Significant Mechanism of Injury, Altered Mental Status, Multiple Injuries, or Critical Finding (*Unstable*) 370
Continue Spine Motion Restriction 370
Consider an Advanced Life Support Request 370
Reconsider the Transport Decision 370
Reassess Mental Status 370
Perform a Rapid Secondary Assessment 372
Assess Vital Signs 382
Obtain a History 384
Prepare the Patient for Transport 385
Provide Emergency Care 386
Trauma Score 388
Modified Secondary Assessment: Trauma Patient with *No* Significant Mechanism of Injury, Altered Mental Status, Multiple Injuries, or Critical Finding (*Stable*) 388
Perform a Modified Secondary Assessment 388
Obtain Vital Signs and History 390
Perform a Rapid Secondary Assessment if Indicated 390
Medical Patient who is not Alert or is Disoriented, is Responding Only to Verbal or Painful Stimuli, or is Unresponsive 392
Perform a Rapid Secondary Assessment for the Medical Patient 392
Assess Vital Signs 395
Position the Patient 396
Obtain a History 397
Provide Emergency Care 398
Make a Transport Decision 398
Responsive Medical Patient who is Alert and Oriented 398
Assess Patient Complaints: OPQRST 399
Complete the History 399
Perform a Modified Secondary Assessment 399
Assess Vital Signs 399

Provide Emergency Care 399
Make a Transport Decision 399
Purposes of the Reassessment 400
Detect Any Change in Condition 401
Identify Any Missed Injuries or Conditions 401
Adjust the Emergency Care 401
Repeat the Primary Assessment 402
Reassess Mental Status 402
Reassess the Airway 402
Reassess Breathing 402
Reassess Oxygenation 402
Reassess Circulation 402
Reestablish Patient Priorities 403
Complete the Reassessment 403
Reassess and Record Vital Signs 403
Repeat Components of the Secondary Assessment for Other Complaints 403
Check Interventions 403
Note Trends in the Patient's Condition 403

PART 7

General Pharmacology and Medication Administration 419

14 General Pharmacology and Medication Administration 419
Introduction 420
Administering Medications 420
Medications the EMT Commonly Administers 421
Medications 421
Medication Names 426
Routes of Administration 427
Medication Forms 428
Essential Medication Information 429
Indications 429
Contraindications 429
Dose 429
Administration 429
Actions 429
Side Effects 429
Key Steps in Administering Medications 430
Obtain an Order from Medical Direction 430
Select the Proper Medication 430
Verify the Patient's Prescription for Patient-Assisted Administration 430
Check the Expiration Date 431
Check for Discoloration or Impurities 431
Verify the Form, Route, and Dose 431
Medication Administration: The Five "Rights" 431
Documentation 431
Reassessment Following Administration 432
Sources of Medication Information 432

PART 8

Shock and Resuscitation 435

15 Shock and Resuscitation 435
Introduction 436
Shock 436
Etiologies of Shock 437
Categories of Shock 440
Specific Types of Shock 443
The Body's Response to Shock 445
Stages of Shock 446
Shock Assessment 449
Age Considerations in Shock 451
General Goals of Prehospital Management of Shock 451
Resuscitation in Cardiac Arrest 452
Pathophysiology of Cardiac Arrest 452
Terms Related to Out-of-Hospital Cardiac Arrest (OHCA) Resuscitation 453
Withholding a Resuscitation Attempt 453
The 2015 AHA Chain of Survival 453
Automated External Defibrillation and Cardiopulmonary Resuscitation 454
Types of Defibrillators 455
Analysis of Cardiac Rhythms 456
When and When Not to Use the AED 458
Recognizing and Treating Cardiac Arrest 458
Assessment-Based Approach: Cardiac Arrest 458
Performing Defibrillation 460
Cardiac Arrest in a Pregnant Patient 461
Transporting the Cardiac Arrest Patient 462
Post-Resuscitation Care 463
Providing for Advanced Cardiac Life Support 463
Summary: Assessment and Care 463
Special Considerations for the AED 463
Safety Considerations 463
AED Maintenance 464
Training and Skills Maintenance 466
Medical Direction and the AED 466
Cardiac Pacemakers 466
Automatic Implantable Cardioverter Defibrillators 466
Automated Chest Compression Devices 467

PART 9

Medical 472

16 Respiratory Emergencies 472

Introduction 473

Respiratory Anatomy, Physiology, and Pathophysiology 473
- Normal Breathing 474
- Abnormal Breathing 474

Respiratory Distress 475

Pathophysiology of Conditions that Cause Respiratory Distress 477
- Obstructive Pulmonary Diseases 478
- Other Conditions That Cause Respiratory Distress 483

Metered-Dose Inhalers and Small-Volume Nebulizers 492
- Using an MDI 493
- Using an SVN 493
- Advair: Not for Emergency Use 496

Age-Related Variations: Pediatrics and Geriatrics 496
- Pediatric Patients 497
- Respiratory Distress or Failure in the Pediatric Patient: Assessment and Care 497
- Geriatric Patients 499
- Respiratory Distress or Failure in the Geriatric Patient: Assessment and Care 499

Assessment and Care: General Guidelines 500
- Assessment-Based Approach: Respiratory Distress 500
- Summary: Assessment and Care 510

17 Cardiovascular Emergencies 520

Introduction 521

Review of the Circulatory System Anatomy, Physiology, and Pathophysiology 521
- The Circulatory System 521
- The Electrocardiogram 528
- Blood Pressure 529
- Inadequate Circulation 529

Cardiac Compromise and Acute Coronary Syndrome 529
- Arteriosclerosis and Atherosclerosis 529
- Acute Coronary Syndrome 530
- The Dangers of Administering Too Much Oxygen in Acute Coronary Syndrome 534
- Other Causes of Cardiac Compromise 535
- Cardiac Arrest 538

Nitroglycerin 538

Age-Related Variations: Pediatrics and Geriatrics 539
- Pediatric Considerations 539
- Geriatric Considerations 539

Assessment and Care: General Guidelines 542
- Assessment-Based Approach: Cardiac Compromise and Acute Coronary Syndrome 542
- Summary: Assessment and Care 546

18 Altered Mental Status, Stroke, and Headache 555

Introduction 556

Altered Mental Status 556
- Assessment-Based Approach: Altered Mental Status 557

Stroke 559
- Neurologic Deficit Resulting from Stroke 559
- Acute Stroke 560
- Pathophysiology of a Stroke 561
- Types of Stroke 562
- Stroke or Transient Ischemic Attack 565
- Assessment-Based Approach: Stroke and Transient Ischemic Attack 568
- Summary: Assessment and Care 577

Headache 577
- Types of Headache 577
- Assessment 579
- Emergency Medical Care 579
- Stroke 580

19 Seizures and Syncope 584

Introduction 585

Seizures 585
- Pathophysiology of Seizures 586
- Types of Seizures 587
- Assessment-Based Approach to Seizure Activity 592
- Summary: Assessment and Care for Seizures 596

Syncope 598

20 Acute Diabetic Emergencies 603

Introduction 604

Understanding Diabetes Mellitus 604
- Glucose (Sugar) 604
- Hormones That Control Blood Glucose Levels 605
- Normal Metabolism and Glucose Regulation 606
- Checking the Blood Glucose Level 608
- Diabetes Mellitus 608

Acute Diabetic Emergencies 610
- Hypoglycemia 610
- Hyperglycemia 614
- Hyperglycemic Condition: Diabetic Ketoacidosis 614
- Hyperglycemic Condition: Hyperglycemic Hyperosmolar Syndrome 618

Assessment-Based Approach: Altered Mental Status in A Diabetic Emergency 620
Scene Size-Up and Primary Assessment 620
History and Secondary Assessment 620
Emergency Medical Care 622
Reassessment 622
Summary: Assessment and Care 622

21 Allergic and Anaphylactic Reactions 629
Introduction 630
Allergic and Anaphylactic Reactions 630
Pathophysiology of Allergic Reaction 630
Pathophysiology of Anaphylactic Reaction 631
Assessment-Based Approach to Anaphylactic Reaction 634
Summary: Assessment and Care 640
Epinephrine 640

22 Toxicologic Emergencies 650
Introduction 651
Poisons and Poisonings 651
Poisons and Routes of Exposure 651
Managing the Poisoning Patient 653
Antidotes 653
Ingested Poisons 653
Assessment-Based Approach: Ingested Poisons 653
Activated Charcoal 656
Inhaled Poisons 658
Assessment-Based Approach: Inhaled Poisons 658
Injected Poisons 660
Assessment-Based Approach: Injected Poisons 660
Absorbed Poisons 661
Assessment-Based Approach: Absorbed Poisons 662
Summary: Assessment and Care 663
Specific Types of Poisoning 666
Food Poisoning 666
Carbon Monoxide Poisoning 666
Cyanide 667
Acids and Alkalis 668
Hydrocarbons 669
Methanol (Wood Alcohol) 669
Isopropanol (Isopropyl Alcohol) 670
Ethylene Glycol 670
Poisonous Plants 671
Suicide Bags and Chemical Suicide by Toxic Gas Inhalation 671
Poison Control Centers 672
Drug and Alcohol Emergencies 672
Assessment-Based Approach: Drug and Alcohol Emergencies 674
Summary: Assessment and Care 678
Managing a Violent Drug or Alcohol Abuse Patient 678
Specific Substance Abuse Considerations 682
Drug Withdrawal 682
The Alcoholic Syndrome 682
The Withdrawal Syndrome 684
Opioids 684
PCP, Cocaine, Amphetamines, Methamphetamines, PABS, and MDMA 688
Tetrahydrocannabinol 689
Medication Overdose 690
Huffing 691

23 Abdominal, Hematologic, Gynecologic, Genitourinary, and Renal Emergencies 696
Introduction 697
Acute Abdomen 697
Abdominal Structures and Functions 697
Abdominal Pain 699
Conditions That Can Cause Acute Abdominal Pain 701
Considerations in Special Populations with Abdominal Pain 706
Assessment-Based Approach: Acute Abdomen 707
Summary: Assessment and Care 710
Hematologic Emergencies 710
Common Hematologic Conditions 710
Gynecologic Emergencies 714
Female Reproductive Structures and Functions 714
Gynecologic Conditions 714
Assessment-Based Approach: Gynecologic Emergencies 717
Genitourinary/Renal Emergencies 719
Genitourinary/Renal Structures and Functions 719
Genitourinary/Renal Conditions 720
Assessment-Based Approach: Genitourinary/Renal Emergencies 723

24 Environmental Emergencies 728
Introduction 729
Heat and Cold Emergencies 729
Regulation of Temperature 729
Exposure to Cold 732
Generalized Hypothermia 732
Pathophysiology of Generalized Hypothermia 733
Nonfreezing Cold Injury 736
Freezing Cold Injury 737
Pathophysiology of Freezing Cold Injury 737
Assessment-Based Approach: Cold-Related Emergency 737
Summary: Assessment and Care—Cold Emergency 745

Exposure to Heat 745
Hyperthermia 745
Pathophysiology of Heat-Related Emergencies 745
Assessment-Based Approach: Heat-Related Emergency 750
Summary: Assessment and Care—Heat Emergency 753
Exercise-Associated Hyponatremia 753
Bites and Stings 755
Snakebite 755
Insect Bites and Stings 757
Assessment-Based Approach: Bites and Stings 758
Marine Life Bites and Stings 760
Lightning Strike Injuries 760
Pathophysiology of a Lightning Strike Injury 761
Assessment of the Lightning Strike Patient 762
Emergency Care for the Lightning Strike Patient 763
High-Altitude Sickness 763
Acute Mountain Sickness 763
High-Altitude Pulmonary Edema 764
High-Altitude Cerebral Edema 764

25 Submersion Incidents: Drowning and Diving Emergencies 768
Introduction 769
Water-Related Emergencies 769
Definitions 769
Incidence of Drowning 770
Prognostic Predictors 770
Pathophysiology of Drowning 770
Diving Emergencies 772
Safety Measures in Water-Related Emergencies 772
Possible Spine Injury 773
Resuscitation 774
Assessment-Based Approach: Drowning and Water-Related Emergencies 774
Summary: Assessment and Care 777
Scuba or Deepwater Diving Emergencies 778
Basic Laws of Physics Related to Scuba or Deepwater Diving Emergencies 780
Decompression Sickness 780

26 Psychiatric Emergencies 785
Introduction 786
Psychiatric Problems and Emergencies 786
Behavioral Changes: Psychiatric or Physical? 787
Psychiatric Problems 789
Violence 794
Mini Assessment for Common Psychiatric Emergencies 795
Dealing with Psychiatric Emergencies 796
Basic Principles 796
Techniques for Treating Psychiatric Emergency Patients 797
Assessment-Based Approach: Psychiatric Emergencies 798
Summary: Assessment and Care 801
Restraining a Patient 801
Legal Considerations 805
Consent 805
Refusal of Care 805
Using Reasonable Force 805
Police and Medical Direction 806
False Accusations 806

PART 10

Trauma 810

27 Trauma Overview: The Trauma Patient and the Trauma System 810
Introduction 811
The Kinetics of Trauma 811
Mass and Velocity 811
Acceleration and Deceleration 812
Energy Changes Form and Direction 812
Impacts 812
Mechanisms of Injury 813
Vehicle Collisions 813
Falls 822
Penetrating Injuries 822
Blast Injuries 825
The Multisystem Trauma Patient 825
The Golden Period and Platinum 10 Minutes 826
The Trauma System 827
Golden Principles of Prehospital Trauma Care 828
Special Considerations in Trauma Care 828

28 Bleeding and Soft Tissue Trauma 833
Introduction 834
External Bleeding 834
Severity 834
Types of Bleeding 835
Methods of Controlling External Bleeding 836
Assessment-Based Approach: External Bleeding 840
Bleeding from the Nose, Ears, or Mouth 841
Internal Bleeding 841
Severity 841
Assessment-Based Approach: Internal Bleeding 842
Factors that Increase Bleeding 844
Hemorrhagic Shock 844
Assessment-Based Approach: Hemorrhagic Shock 845
Summary: Assessment and Care 846

Soft Tissue Trauma 847
The Skin 847
Closed Soft Tissue Injuries 849
Contusions 849
Hematomas 849
Crush Injuries 849
Assessment-Based Approach: Closed Soft Tissue Injuries 849
Open Soft Tissue Injuries 850
Abrasions 850
Amputations 852
Penetrations/Punctures 852
Crush Injuries 853
Other Soft Tissue Injuries 853
Assessment-Based Approach: Open Soft Tissue Injuries 854
Dressings and Bandages 857
Dressings 857
Bandages 857
Pressure Dressings 858
General Principles of Dressing and Bandaging 858
Summary: Assessment and Care 859

29 Burns 873
Introduction 874
Review of the Anatomy of the Skin 874
Pathophysiology of Burns 875
Circulatory System 875
Respiratory System 875
Renal System (Kidneys) 875
Nervous and Musculoskeletal Systems 876
Gastrointestinal System 876
Classification of Burns 876
Classifying Burns by Depth 876
Classifying Burns by Severity 877
Types of Burns 881
Causes of Burns 881
Assessment-Based Approach: Burns 883
Chemical Burns 886
Electrical Burns 887
Summary: Assessment and Care 888

30 Musculoskeletal Trauma and Nontraumatic Fractures 896
Introduction 897
Musculoskeletal System Review 897
The Muscles 897
Tendons and Ligaments 897
Cartilage 897
The Skeletal System 898
Injuries to Bones and Joints 900
Types of Injuries 900
Mechanism of Injury 902
Critical Fractures: The Femur and the Pelvis 903
Assessment-Based Approach: Bone or Joint Injuries 904
Summary: Assessment and Care 907
Basics of Splinting 907
General Rules of Splinting 907
Splinting Equipment 908
Hazards of Improper Splinting 911
Splinting Long Bone Injuries 912
Splinting Joint Injuries 912
Traction Splinting 912
Splinting Specific Injuries 913
Pelvic Fracture 913
Compartment Syndrome 914
Nontraumatic Fractures 914

31 Head Trauma 927
Introduction 928
Anatomy of the Skull and Brain 928
The Skull 928
The Brain 928
Head Injury 930
Scalp Injuries 930
Skull Injuries 930
Brain Injuries 930
Pathophysiology of Traumatic Brain Injury 930
Types of Head and Brain Injuries 931
Assessment-Based Approach: Head Injury 934
Summary: Assessment and Care 942

32 Spinal Injury and Spine Motion Restriction 947
Introduction 948
Anatomy and Physiology of Spinal Injury 948
The Nervous System 948
The Skeletal System 948
Common Mechanisms of Spinal Injury 950
Spinal Column Injury Versus Spinal Cord Injury 952
Emergency Care for Suspected Spinal Injury 954
Assessment-Based Approach: Spinal Injury 954
Summary: Assessment and Care 961
Guidelines for Spine Motion Restriction 961
Historical Perspective: Spinal Immobilization Versus Spine Motion Restriction 961
Tools for SMR 966
Spine Motion Restriction Techniques 968
The Ambulatory Patient 968
The Patient Found Supine or Prone 969
The Patient Seated in a Vehicle 970

Special Considerations 972
Helmets 972
SMR in Infants and Children 974

33 Eye, Face, and Neck Trauma 998
Introduction 999
Anatomy of the Eye, Face, and Neck 999
The Eye 999
The Face 1000
The Neck 1000
Eye, Face, and Neck Injuries 1001
Assessment-Based Approach: Eye, Face, and Neck Injuries 1001
Specific Injuries Involving the Eye, Face, and Neck 1002
Injuries to the Eye 1002
Injuries to the Neck 1010

34 Chest Trauma 1020
Introduction 1021
The Chest 1021
Anatomy of the Chest 1021
General Categories of Chest Injuries 1023
Specific Chest Injuries 1024
Assessment-Based Approach: Chest Trauma 1030
Summary: Assessment and Care—Chest Trauma 1035

35 Abdominal and Genitourinary Trauma 1041
Introduction 1042
The Abdomen 1042
Anatomy of the Abdominal Cavity 1042
Abdominal Injuries 1044
Assessment-Based Approach: Abdominal Trauma 1044
Summary: Assessment and Care—Abdominal Trauma 1047
Genital Trauma 1048

36 Multisystem Trauma and Trauma in Special Patient Populations 1053
Introduction 1054
Multisystem Trauma 1054
Golden Principles of Prehospital Multisystem Trauma Care 1054
Trauma in Special Patient Populations 1056
Trauma in Pregnant Patients 1056
Trauma in Pediatric Patients 1057
Trauma in Geriatric Patients 1059
Trauma in Cognitively Impaired Patients 1060
Assessment-Based Approach: Multisystem Trauma and Trauma in Special Patient Populations 1061
Scene Size-Up 1061
Primary Assessment 1061
Secondary Assessment 1062
Emergency Medical Care 1062
Reassessment 1063

PART 11
Special Patient Populations 1066

37 Obstetrics and Care of the Newborn 1066
Introduction 1067
Anatomy and Physiology of the Obstetric Patient 1067
Anatomy of Pregnancy 1068
Menstrual Cycle 1069
Prenatal Period 1069
Physiologic Changes in Pregnancy 1070
Antepartum (Predelivery) Emergencies 1070
Antepartum Condition Causing Severe Vomiting, Dehydration, and Electrolyte Imbalance: Hyperemesis Gravidarum 1070
Antepartum Conditions Causing Hemorrhage 1071
Summary: Assessment and Care—Antepartum (Predelivery) Emergency 1080
Labor and Normal Delivery 1081
Labor 1081
Assessment-Based Approach: Active Labor and Normal Delivery 1086
Abnormal Delivery 1091
Assessment-Based Approach: Active Labor with Abnormal Delivery 1091
Intrapartum Emergencies 1092
Summary: Assessment and Care—Active Labor and Delivery 1100
Postpartum Complications 1100
Care of the Newborn 1102
Assessment-Based Approach: Care of the Newborn 1102

38 Pediatrics 1116
Introduction 1117
Dealing with Caregivers 1117
Dealing with the Child 1118
Developmental Characteristics 1118
Anatomic and Physiologic Differences 1120
Assessment-Based Approach to Pediatric Emergencies 1124
Scene Size-Up 1124
Primary Assessment 1124
Secondary Assessment 1129
Special Considerations for the Physical Exam 1129
Special Considerations for Assessing the Vital Signs 1132
Special Considerations for Taking a History 1132
Reassessment 1133

Airway and Respiratory Problems in Pediatric Patients 1133
Early Respiratory Distress 1133
Decompensated Respiratory Failure 1134
Respiratory Arrest 1136
Airway Obstruction 1136
Signs and Symptoms of a Respiratory Emergency 1137
Emergency Medical Care—Respiratory Emergencies 1137
Emergency Medical Care—Foreign Body Airway Obstruction 1140
Specific Pediatric Respiratory and Cardiopulmonary Conditions 1143
Croup 1143
Epiglottitis 1143
Asthma 1144
Bronchiolitis 1146
Pneumonia 1146
Congenital Heart Disease (CHD) 1148
Shock 1148
Cardiac Arrest 1149
Summary: Pediatric Respiratory and Cardiopulmonary Emergencies 1150
Other Pediatric Medical Conditions and Emergencies 1150
Seizures 1150
Altered Mental Status 1154
Drowning 1156
Fever 1157
Meningitis 1157
Gastrointestinal Disorders 1158
Poisoning 1159
Brief Resolved Unexplained Events 1159
Sudden Infant Death Syndrome 1160
Pediatric Trauma 1162
Trauma and the Pediatric Anatomy 1162
Infant and Child Car Seats in Trauma 1164
Four-Point Spine Motion Restriction of an Infant or Child 1167
Injury Prevention 1167
Child Abuse and Neglect 1168
Emergency Medical Care Guidelines for Child Abuse 1169
Special Care Considerations 1169
Emergency Medical Services for Children 1169
Family-Centered Care 1170
Taking Care of Yourself 1170

39 Geriatrics 1181
Introduction 1182
Effects of Aging On Body Systems 1182
The Cardiovascular System 1182
The Respiratory System 1184
The Neurologic System 1184
The Gastrointestinal System 1186
The Endocrine System 1186
The Musculoskeletal System 1186
The Renal System 1187
The Integumentary System 1187
Special Geriatric Assessment Findings 1187
Assessment Finding: Chest Pain or Absence of Chest Pain 1187
Assessment Finding: Shortness of Breath (Dyspnea) 1189
Assessment Finding: Altered Mental Status 1191
Assessment Finding: Signs of Trauma or Shock 1195
Assessment Finding: Gastrointestinal Bleeding 1196
Assessment Finding: Environmental Temperature Extremes 1197
Elder/Geriatric Abuse 1197
Assessment-Based Approach: Geriatric Patients 1198
Scene Size-Up 1199
Primary Assessment 1200
Secondary Assessment 1202
Emergency Medical Care and Reassessment 1204

40 Patients with Special Challenges 1209
Introduction 1210
Recognizing the Patient with Special Challenges 1211
Sensory Impairments 1211
Hearing Impairment 1211
Vision Impairment 1211
Speech Impairment 1212
Accommodations for Patients with Sensory Impairments 1212
Cognitive and Emotional Impairments 1212
Mental or Emotional Impairments 1212
Developmental Disabilities 1213
Autism and EMS 1213
Accommodations for Patients with Mental, Emotional, or Developmental Impairments 1214
Brain-Injured Patients 1215
Accommodations for Brain-Injured Patients 1215
Paralysis 1216
Accommodations for Paralyzed Patients 1216
Obesity 1217
Accommodations for Obese Patients 1218
Homelessness and Poverty 1219
Accommodations for Patients Who Are Homeless or Poor 1220
Abuse 1221
Human Trafficking 1221
The Human Trafficking Victim 1221
EMS Management for a Suspected Human Trafficking Victim 1222

Domestic Violence 1223
The Domestic Violence Victim 1223
EMS Management for a Victim of Domestic Abuse or Violence 1224
Technology Dependence 1225
Airway and Respiratory Devices 1226
Medical Oxygen 1227
Apnea Monitors 1227
Pulse Oximetry 1228
Tracheostomy Tubes 1228
CPAP and BiPAP 1229
Home Mechanical Ventilators 1230
Accommodations for Patients with Airway or Respiratory Devices 1231
Vascular Access Devices 1233
Central Intravenous Catheters 1233
Central Venous Lines 1233
Implanted Ports 1233
Accommodations for Patients with Vascular Access Devices 1233
Ventricular Assist Device 1234
Special Assessment Considerations for Patients with an Implanted VAD 1234
Accommodations for Patients with an Implanted VAD 1234
Vagus Nerve Stimulator 1235
Accommodations for Patients with a VNS 1235
Renal Failure and Dialysis 1235
Accommodations for Patients on Dialysis 1236
Gastrointestinal and Genitourinary Devices 1236
Feeding Tubes 1236
Ostomy Bags 1237
Urinary Tract Devices 1238
Accommodations for Patients with Gastrointestinal and Genitourinary Devices 1238
Intraventricular Shunts 1239
Accommodations for Patients with Intraventricular Shunts 1239
Terminally Ill Patients 1240
Accommodations for Terminally Ill Patients 1241

41 The Combat Veteran 1244
Introduction 1245
The Psychophysiology of Stress Response 1246
Combat Veterans 1246
The Nature of PTSD 1246
Associated Signs and Symptoms of PTSD 1248
Alcohol and Drug Use 1248
Danger to Self or Other 1249
Signature Wounds of the Combat Veteran 1249
TBI Versus PTSD: Signs and Symptoms 1250
Assessing and Providing Emergency Care to Combat Veterans: Recommendations for EMTs 1251

PART 12

EMS Operations 1255

42 Ambulance Operations and Air Medical Response 1255
Introduction 1256
Culture of Safety in EMS 1256
Crew Resource Management 1257
Driving the Ambulance 1259
Laws, Regulations, and Ordinances 1259
Driving Excellence 1259
Warning Devices 1263
Colors and Markings 1263
Warning Lights and Emergency Lights 1263
Using Your Siren 1263
Using Your Air Horn 1264
Roadway Incident Scene Safety 1264
High-Visibility Apparel 1264
Safety Benchmarks 1265
Phases of an Ambulance Call 1265
Daily Prerun Preparation 1265
Dispatch 1266
En Route to the Scene 1267
At the Scene 1267
En Route to the Receiving Facility 1269
At the Receiving Facility 1270
En Route to the Station or Response Area 1270
Post Run 1271
Air Medical Transport 1272
When to Request Air Medical Transport 1272
Requesting Air Medical Transport 1273
Additional Considerations for Air Medical Transport 1273
Setting Up a Landing Zone 1273
Security and Safety 1275
Operational Security Measures 1275
Carbon Monoxide in Ambulances 1276

43 Gaining Access and Patient Extrication 1282
Introduction 1283
Planning Ahead 1283
Dispatch 1283
Location 1283
Motor Vehicle Collisions 1284
Sizing up the Scene 1284
Perform a 360-Degree Assessment 1284

Evaluate the Need for Additional Resources 1284
Personal Protective Equipment 1284
Scene Safety 1285
Locate All Patients 1286
Vehicle Safety 1288
Gaining Access 1288
Residential Access 1288
Motor Vehicle Access 1289
Extrication 1290
The Role of the EMT 1290
Caring for the Patient 1291
Specialized Stabilization, Extrication, and Disentanglement Techniques 1291
Stabilizing a Vehicle 1291
Extricating a Patient 1293

44 Hazardous Materials 1300
Introduction 1301
Identifying Hazardous Materials 1301
What Is a Hazardous Material? 1301
Placards and Shipping Papers 1305
Using Your Senses 1307
Resources 1308
Training Required by Law 1309
Guidelines for Hazardous Materials Rescues 1310
General Rules 1310
Decontamination 1311
Incident Management 1311
Emergency Procedures 1314
Radiation Emergencies 1315
Criminal Use of Hazardous Materials 1317
Terrorist Attacks 1318

45 Multiple-Casualty Incidents and Incident Management 1322
Introduction 1323
Multiple-Casualty Incidents 1323
National Incident Management System 1323
Incident Command System 1325
Triage 1326
Primary and Secondary Triage 1326
START Triage System 1328
JumpSTART Pediatric Triage System 1329
SALT Triage 1331
Patient Tagging 1331
Treatment 1333
Staging and Transport 1333
Communications 1334
Follow-Through 1334
Reducing Posttraumatic and Cumulative Stress 1335
Disaster Management 1335
Requirements of Effective Disaster Assistance 1336
Warning and Evacuation 1336
Disaster Communications Systems 1336
The Psychological Impact of Disasters 1337

46 EMS Response to Terrorist Incidents 1340
Introduction 1341
Weapons of Mass Destruction 1341
Prehospital Response to Terrorism Involving WMD 1343
Supplies and Equipment 1343
Medical Direction 1343
Provider Preparation 1343
Responding to the Scene 1344
Issues of Scene Safety 1344
Role of the EMT at the Terrorist Incident Involving WMD 1345
Conventional Explosives and Incendiary Devices 1345
Explosives 1345
Primary, Secondary, Tertiary, and Quaternary Effects 1346
Body Position 1346
Types of Injuries 1346
Incendiary Devices 1347
Chemical Agents 1347
Properties of Chemical Weapons 1347
Types of Chemical Agents 1348
Biological Agents 1351
Specific Biological Agents 1352
Emergency Medical Care for Biological Agents 1353
Nuclear Weapons and Radiation 1353
Radiation 1353
Blast Injuries 1354
Thermal Burns 1354
Radiological Dispersal Devices/Radiological Exposure Devices 1354
Improvised Nuclear Device 1355
Assessment and Care for Nuclear Detonation and Radiation Injuries 1355
Personal Protection and Patient Decontamination 1356
Active Shooter Incident 1356
Tactical EMS 1356
Cyberterrorism 1357

Appendix 1 ALS-Assist Skills 1359
Appendix 2 Advanced Airway Management 1366
Appendix 3 Agricultural and Industrial Emergencies 1398
Answer Key 1407
Glossary 1445
Index 1461

Key Features

Assessment Summaries

Cardiac Arrest 464
Respiratory Distress 510
Cardiac Compromise and Acute Coronary Syndromes 548
Stroke 578
Seizures 597
Acute Diabetic Emergency: Suspected Hypoglycemia 623
Anaphylactic Reaction 640
Poisoning Emergency 663
Drug or Alcohol Emergency 679
Acute Abdominal Pain 711
Generalized Hypothermia Emergency 746
Heat Emergency 754
Drowning 777
Behavioral Emergency 802
Bleeding and Hemorrhagic Shock 846
Soft Tissue Trauma 860
Burn Emergency 889
Musculoskeletal Injury 908
Head Injury 942
Spine Injury 961
Chest Trauma 1036
Abdominal Trauma 1047
Antepartum (Predelivery) Obstetric Emergency 1080
Obstetric Emergency—Active Labor and Delivery 1101
Respiratory or Cardiopulmonary Emergency in the Pediatric Patient 1151

Emergency Care Protocols

Cardiac Arrest 464
Respiratory Distress 511
Cardiac Compromise and Acute Coronary Syndromes 549
Stroke 579
Seizures 598
Acute Diabetic Emergency 624
Anaphylactic Reaction 641
Poisoning Emergency 664
Drug or Alcohol Emergency 680
Acute Abdominal Pain 711
Generalized Hypothermia Emergency 747
Heat Emergency 755
Drowning 778
Behavioral Emergency 803
Bleeding and Hemorrhagic Shock 847
Soft Tissue Trauma 861
Burn Emergency 890
Musculoskeletal Injury 909
Head Injury 943
Spine Injury 962
Eye Injury 1007
Facial Injury 1011
Neck Injury 1012
Chest Trauma 1037
Abdominal Trauma 1048
Antepartum (Predelivery) Obstetric Emergency 1081
Obstetric Emergency—Active Labor and Delivery 1102
Newborn Infant 1109
Pediatric Shock 1149
Respiratory or Cardiopulmonary Emergency in the Pediatric Patient 1152
Pediatric Seizures 1155
Pediatric Altered Mental Status 1156
Pediatric Drowning 1157
Pediatric Fever 1158
Pediatric Poisoning 1160
Sudden Infant Death Syndrome 1161
Pediatric Trauma 1168
Pediatric Abuse and Neglect 1170

Emergency Care Algorithms

Automated External Defibrillation 465
Respiratory Distress/Failure/Arrest 512
Cardiac Compromise 550
Stroke 580
Seizures 599
Acute Diabetic Emergency 625
Anaphylactic Reaction 642
Poisoning Emergency 665
Drug or Alcohol Emergency 681
Acute Abdominal Pain 712
Cold Emergency 748
Heat Emergency 756
Drowning Emergency 779
Psychiatric Emergency 804
Bleeding and Shock 848
Open Soft Tissue Trauma 862
Burn Emergency 891
Musculoskeletal Injury 910
Head Injury 944
Spine Injury 963
Chest Trauma 1038
Abdominal Trauma 1049
Antepartum (Predelivery) Obstetric Emergency 1082
Obstetric Emergency—Active Labor and Delivery 1103
Newborn Care and Resuscitation 1110
Respiratory or Cardiopulmonary Emergency in the Pediatric Patient 1153

Drug Profiles

The Drug Profiles are intended to provide additional information about the medications and their administrations.

Beta2 agonist Metered-Dose Inhaler (MDI)/ Small-Volume Nebulizer (SVN) 494–496
Nitroglycerin 540
Aspirin 547
Oral Glucose 613
Epinephrine 643
Activated Charcoal 657
Naloxone 687

EMT Skills

Safe Glove Removal 41
Power Lift 119
Direct Ground Lift 120
Extremity Lift 121
Direct Carry 121
Draw Sheet Method 122
Loading the Roll-In Wheeled Stretcher 122
Bariatric Stretchers 123
Moving a Patient on a Stair Chair 123
Applying the Scoop Stretcher 124
Suctioning Technique 274
Inserting an Oropharyngeal Airway 275
Inserting a Nasopharyngeal Airway 276
Patient Has Breathing Difficulty: When and How to Intervene 277
Spine Motion Restriction During Bag-Valve Ventilation 278
Continuous Positive Airway Pressure (CPAP) Procedure 279
Initiating Oxygen Administration 280
Taking Blood Pressure by Auscultation 310
Taking Blood Pressure by Palpation 310
Taking Orthostatic Vital Signs 311
Pulse Oximetry 311
Scene Characteristics 330
Log Rolling from a Prone to a Supine Position When Spinal Injury Is Suspected 404
Assessing Capillary Refill in Children and Infants 404
The Secondary Assessment: Anatomic Approach 405
Common Signs of Trauma 408
The Rapid Secondary Assessment for the Trauma Patient 410
The Rapid Secondary Assessment for the Medical Patient 412
The Reassessment 414
Using a Semiautomated AED Ideally, at Least Two EMTs Should be Present—One to Operate the AED and the Other to Perform CPR. 468
Auscultating the Chest 513
Administering Medication by Metered Dose Inhaler 514
Administering a Metered-Dose Inhaler with a Valved Holding Chamber 515
Administering Nebulized Medications 516
Assisting a Patient with Prescribed Nitroglycerin 551
Testing the Blood Glucose Level with a Glucose Meter 626
Administering an Epipen Epinephrine Auto-Injector 646
Routes of Exposure 692
Administering Activated Charcoal 693
Restraining the Combative Patient 807
Bleeding Control by Direct Pressure 863
Application of a Tourniquet 864
Controlling a Nosebleed 865
Emergency Care for Shock 865
Soft Tissue Injuries 866
Gunshot Wounds 867
Stabilizing an Impaled Object 867
Bandaging 868
The Self-Adhering Roller Bandage 870
Superficial and Partial-Thickness Burns 892
Full-Thickness Burns 892
Electrical Burn 893
General Splinting Rules 915
Applying a Vacuum Splint 916
Splinting a Long Bone 917
Splinting a Joint 918
Applying a Bipolar Traction Splint 918
Applying a Unipolar Traction Splint 920
Applying a Sling and Swathe 921
Splinting Specific Injuries 922
Neurologic Assessment of Motor and Sensory Function 975
Establish Manual In-Line Motion Restriction 977
Cervical Collars 977
Sizing a Cervical Collar 978
Applying a Cervical Collar to a Seated Patient 979
Applying a Cervical Collar to a Supine Patient 979
Applying an Adjustable Collar to a Seated Patient 980
Applying an Adjustable Collar to a Supine Patient 981
Four-Rescuer Log Roll and Spine Motion Restriction Using a Backboard 982
Securing a Patient to a Long Board 983
Three-Rescuer Log Roll 984
Two-Rescuer Log Roll 985
Examples of Spine Motion Restriction Devices 985
Assessment for Spinal Injury in an Ambulatory Patient 986
Spine Motion Restriction in an Ambulatory Patient 987
Spine Motion Restriction in Self-Extrication from a Motor Vehicle 988
Spine Motion Restriction of a Seated Patient with a Ferno K.E.D. Extrication Device 989
Rapid Extrication 990
Helmet Removal 991
Helmet Removal—Alternative Method 992
Removing a Football Helmet Face Mask 993

Extrication from a Child Safety Seat 994
Removal of Foreign Object—Upper Eyelid 1013
Emergency Care—Impaled Object in the Eye 1013
Injuries to the Face 1014
Injuries to the Mouth, Jaw, Cheek, and Chin 1014
Injuries to the Nose 1015
Injuries to the Ear 1015
Injuries to the Neck 1016
Emergency Care—Severed Blood Vessel of the Neck 1016
Dressing an Abdominal Evisceration 1050
Childbirth 1111
Neonatal Resuscitation 1112
Pediatric Primary Assessment 1171
Checking Capillary Refill 1172
The Pediatric Physical Exam 1173
Oropharyngeal Airway 1176
Nasopharyngeal Airway 1176
A Pediatric Spine Motion Restriction System 1177
Child Abuse and Neglect 1178
Spine Motion Restriction for a Patient with Kyphosis 1206
Elements of the Daily Vehicle Inspection 1277
En Route to the Receiving Facility 1277
Post Run 1279
Breaking an Automobile Window 1295
Stabilizing a Vehicle on its Side 1295
Extricating an Entangled Patient 1296
Extricating a Patient from a Vehicle on Its Side 1298
Hazardous Materials Protective Equipment 1319
Assisting with IV Administration 1363
ECG 3-Lead Placement 1364
ECG 12-Lead Placement 1364
Orotracheal Intubation 1394
Orotracheal Suctioning 1395
Nasogastric Intubation 1396

Preface

Congratulations on your decision to undertake an EMT education program. The field of emergency medical services is extremely rewarding and will provide you with experiences you will find both challenging and gratifying.

Be Prepared

As an EMT student, you have a few pressing concerns. You want to be prepared:

- To pass your course exams
- To pass the credentialing exam that allows you to practice as an EMT
- To treat patients to the best of your ability
- To do well in all aspects of your job

As the authors, we want to assure you that *Prehospital Emergency Care,* 11th Edition, is written to help you achieve those goals.

It All Makes Sense

The key to the above goals—passing your exams, providing excellent patient care, and doing well in your job—is understanding how everything fits together:

- A basic understanding of anatomy, physiology, and pathophysiology will allow you to better understand signs, symptoms, and emergency care.
- An anatomical and body systems approach to the physical exam will link conditions to assessment findings.
- Knowledge of the presentations of common medical conditions and traumatic injuries encountered in the prehospital environment will enable you to perform efficient and accurate assessments.
- A diagnostic-based approach to patient assessment will allow you to form a differential field impression of the condition or injury.
- An assessment-based approach to patient assessment will allow you to identify and provide immediate emergency care for life-threatening conditions or injuries.
- You will learn how to provide the most efficient and effective emergency care.

The good news is that—although what you have to learn may seem daunting in the beginning—it all makes sense. In fact, that is the philosophy behind this textbook. Our purpose has been to show you at every step of your EMT education program how:
It all makes sense!

Features

All of the features in this textbook are designed to help you navigate the anatomy, physiology, pathophysiology, assessment findings, medical conditions, traumatic injuries, and emergency care to best prepare you to provide excellent emergency medical services to the patient—beginning with the dispatch of the call, followed by assessment and management of the patient and delivery to the medical facility, through writing your prehospital care report. In addition to the many new photographs and illustrations, in the "clinical" chapters (on airway care, the medical chapters, and the trauma chapters) you will find:

- Assessment Tips
- Pathophysiology Pearls
- Drug Profiles
- Assessment Summaries
- Emergency Care Protocols
- Emergency Care Algorithms
- Pathophysiology notes within the Case Study Follow-Ups to explain the "why" of what you observe about the patient

And a special feature that appears throughout Chapter 13, "Patient Assessment":

- Critical Findings,

which explains, at every step of the assessment, critical conditions/signs/symptoms you may find . . . what might be causing them . . . and specifically what you should do when your assessment of the patient reveals one of these critical findings.

EMTs are often taught **WHAT** signs and symptoms they should expect to see in certain conditions and **WHAT** should be done; however, the **WHY** of assessment and emergency care is often not well addressed. Three of the features, "Pathophysiology Pearls," "Assessment Tips," and the new pathophysiology notes in the clinical-chapter Case Study Follow-Ups —in addition to expanded discussion within the chapters—provide you with a basic understanding so that you can better comprehend **WHY** you are seeing signs and symptoms and **WHY** you are providing specific emergency care.

The Assessment Summaries, Emergency Care Protocols, Emergency Care Algorithms, and Critical Thinking features provide the most up-to-date strategies for providing competent care. These features and the entire text have been updated to conform to the latest American Heart Association guidelines.

In Your EMS Career

In your EMS career, you will respond to a variety of calls in uncontrolled environments requiring confidence, compassion, and a high degree of competence. As an EMT, you will be put to the test to think critically and respond instantaneously. The foundation for these skills will be provided in your education program; you will learn further and gain better clinical insight through patient contact, continuing education, and experience. Once you have read this textbook and complete your EMT program, you will have only begun your educational experience as an EMT. Every day you should strive to learn something new that may enhance your emergency patient care. Because of the dynamic nature of emergency medical services, you will become a lifelong learner.

Pathophysiology

As an EMT, you will be required to learn about many patient conditions and injuries that you will encounter in the prehospital environment. Identifying these conditions and injuries is most often based on the recognition of specific signs and symptoms and history findings. Not only is it difficult to memorize the myriad of signs and symptoms for each condition or injury, it is not desirable, because not every patient presents with just one condition or injury or all of the same signs and symptoms. A good basic foundation of pathophysiology helps you to understand and explain the "why" behind the patient presentation. There is no need to memorize when you understand and can explain why each sign or symptom is occurring. Putting this together with a fundamental understanding of the pathophysiology of the conditions and a thorough approach to patient assessment will allow you to quickly recognize immediate life threats and provide excellent emergency care. Don't memorize, but understand. This is the foundation to making "it all make sense!"

The Importance of Patient Assessment

Patient assessment is one of the most important skills that an EMT performs, requiring good practical ability and also the capability to think critically. You must take each finding from the assessment, determine if an immediate life-saving intervention is required, store the information learned in the back of your mind as you continue with the assessment, and finally put all the pieces of the assessment together to provide effective emergency medical care. The challenge is similar to putting a puzzle together. You start out with individual pieces of the puzzle that have to be connected to form a meaningful picture. The pieces of the puzzle correlate to signs, symptoms, and other findings of the assessment. You must take the findings, consider them individually, and then put them together to form a whole picture of your patient. Specific findings are meaningless without fitting them into the entire picture.

Prehospital Emergency Care, 11th Edition, provides a strong, comprehensive approach to patient assessment, which is reinforced at several points in the chapters—in the Case Study, chapter text, Assessment-Based Approach, Assessment Summaries, and Algorithms. This approach reinforces assessment information and also provides an alternative learning method. You will find the necessary clinical information integrated into the assessment approach for each section, unlike other sources that integrate the assessment information into the clinical information.

This textbook uses a two-tiered approach to teaching emergency medical care: assessment based and diagnostic based. An assessment-based approach to patient injuries and illnesses teaches you to identify life-threatening conditions and provide immediate interventions to reverse those problems. An assessment-based approach to acute patient care is followed no matter what level of care is provided. Once you have managed life-threatening conditions, you will then move to the next level of assessment, the diagnostic-based approach. The diagnostic-based approach entails putting the signs, symptoms, and other assessment findings together to come to a probability of what conditions the patient may be suffering from. Many EMS providers refer to this as their "differential field impression." *Prehospital Emergency Care,* 11th Edition, presents the necessary information to move naturally, successfully, and effectively from the assessment-based approach to the diagnostic-based approach.

Using Medical Terminology

As you progress through your education program, you will learn a new system of communication that involves the use of appropriate medical terminology. It is important to establish a basic understanding of medical terminology so that you may communicate effectively, both orally and in writing, with other members of the medical team. *Prehospital Emergency Care,* 11th Edition, addresses medical terminology in Chapter 7, "Anatomy, Physiology, and Medical Terminology," and has integrated a basic foundation of medical terminology into each chapter (see the terms in bold type and the glossary at the end of the book) that will help you to enhance your professional image and communication skills. You should expand your medical terminology base as you continue your education.

As You Begin Your EMS Career

We wish you the best of luck as you begin your career in emergency medical services. Our best piece of advice to you is to provide the best emergency care possible and always do what is right for the patient. This will allow you to contribute to the mission of emergency medical services.

Good luck and best wishes!

Joseph J. Mistovich and Keith J. Karren

What's New in the 11th Edition?

Prehospital Emergency Care, 11th Edition, continues to meet the National EMS Education Standards published by the National Highway Traffic Safety Administration in 2009 and to reflect the latest and best medical knowledge and practices in emergency medical services in the United States. Recognizing, as well, that equipment, standards, and practices vary from one state and local EMS service to another, the statement "follow local protocols" appears in numerous places throughout the text.

The content of *Prehospital Emergency Care,* 11th Edition, is summarized here, with emphasis on "what's new" in this edition. The text's table of contents is organized to follow the National EMS Educational Standards.

Part 1: Preparatory and Public Health

The chapters that fall under the first two standards, "Preparatory" and "Public Health," set the foundation for the chapters that follow with such basic topics as EMS systems; research; public health; workforce safety and wellness; medical, legal, and ethical issues; documentation; communication; and lifting and moving patients.

What's New?

- Chapter 1, "Emergency Medical Care Systems, Research, and Public Health," includes new and updated information on **types of EMS services, medical oversight of EMS,** and **EMS research.** New sections on **evidence-based guidelines (EBG), mobile integrated healthcare (MIH),** and **community paramedicine (CP)** have been added.
- Chapter 2, "Workforce Safety and Wellness of the EMT," includes new information on emergency infectious diseases (EID), including new sections on **Ebola virus** and **zika virus disease.** A new discussion of **clandestine drug labs** is included.
- Chapter 3, "Medical, Legal, and Ethical Issues," regarding a patient's ability to consent to or refuse care, includes a new explanation of the terms **competence** and **capacity** — noting that while EMS personnel cannot judge a patient's *competence* (a legal judgment that can only be made in a court of law), EMS and other medical personnel can judge a patient's *capacity* (a medical assessment) to understand and make rational decisions.
- Chapter 4, "Documentation," has a new list of **documentation goals** and expanded information on **mandatory reporting**.
- Chapter 5, "Communication," has a new information and new sections on new and advanced communications technology, including **FirstNet**, a nationwide public safety broadband, **land mobile radio systems (LMRS),** as well as **telemetry** and **land mobile satellite communications.**
- Chapter 6, "Lifting and Moving Patients," places new emphasis on **spine motion restriction** and **self restriction** to replace former emphasis on immobilization of patients with suspected spinal injury, on the basis that total "immobilization" of the spine is impossible, and that "immobilization" to a hard spine board has been found in many instances to worsen injuries. (The complete explanation of spine motion restriction is in Chapter 32, "Spinal Trauma and Spine Motion Restriction."

Part 2: Anatomy, Physiology, and Medical Terminology

These standards are covered in a single chapter, Chapter 7, "Anatomy, Physiology, and Medical Terminology." This chapter has no significant changes from the prior edition.

Part 3: Pathophysiology

This standard is covered in one chapter, Chapter 8, "Pathophysiology." This chapter is largely unchanged from the prior edition.

Part 4: Life Span Development

This standard is covered in one chapter, Chapter 9, "Life Span Development."

What's New?

- Chapter 9, "Life Span Development," presents a table of **vital signs** revised from the prior edition in accordance with the values included **American Heart Association and American Academy of Pediatric Life Support *Pediatric Advanced Life Support 2016.*** (Vital signs values throughout the text have been revised to be consistent with these.).

Part 5: Airway Management, Artificial Ventilation, and Oxygenation

This standard is covered in one chapter, "Airway Management, Artificial Ventilation, and Oxygenation."

What's New?

- Chapter 10, "Airway Management, Artificial Ventilation, and Oxygenation," includes revised information on **cricoid pressure** to reflect contraindications and modified recommendations for its use. The **CPAP** section is revised to explain uses to overcome PEEP and auto-PEEP (exhalation difficulties) and possible uses of CPAP in children. Importantly, there are updated recommendations for **oxygen administration in medical patients** and **trauma patients** to reflect current recommendations of the **American Heart Association** and the **American College of Surgeons** (and revised throughout the text to be consistent with these).

Part 6: Assessment

The chapters that fall under the "Assessment" standard are those that detail vital signs, monitoring devices, and history taking as well as scene size-up and the process of patient assessment.

What's New?

- Chapter 11, "Vital Signs, Monitoring Devices, and History Taking," has updated **vital signs** values as recommended by the AHA and American College of Surgeons (as was noted for Chapter 9). Chaper 11 includes an increased emphasis on **early pulse oximeter use**.
- Chapter 12, "Scene Size-Up," has a new section, **"Violence Toward EMS Personnel"** (what to anticipate; how to protect yourself). Also included is new information on the dangers of calls to **clandestine drug labs** (and how to protect yourself).
- Chapter 13, "Patient Assessment," includes new **spine motion restriction** recommendations (more fully explained in Chapter 32 "Spinal Trauma and Spine Motion Restriction"). There are updated guidelines for **oxygen therapy goals for medical patients** (as recommended by AHA) **and for trauma patients** (as recommended by the American College of Surgeons). A new section has been added on **naloxone (Narcan) administration for opioid overdose.**

Part 7: General Pharmacology and Medication Administration

This standard is covered in one chapter, "General Pharmacology and Medication Administration."

What's New?

- Chapter 14, "General Pharmacology and Medication Administration," contains several new elements, including distinguishing two ways EMTs may administer medication: **EMT medication administration** and **patient-assisted medication administration.** There are new **cautions regarding administration of oxygen** (which can be harmful in some circumstances). The chapter includes new information on **manual administration of epinephrine for anaphylactic reaction** (in lieu of expensive auto-injectors). There is also a new section on **intranasal administration of naloxone using a mucosal atomizer device (MAD)**.

Part 8: Shock and Resuscitation

This standard is covered in one chapter, "Shock and Resuscitation."

What's New?

- Chapter 15, "Shock and Resuscitation," now identifies just **two stages of shock: compensatory and decompensatory** ("irreversible shock" is no longer identified as a stage of shock). There is an extensive new section on **sepsis** and **septic shock**, a major cause of death in the United States. There is expanded information on **multiple organ dysfunction syndrome (MODS),** and there are new sections on **cardiac arrest in the pregnant patient** and on **post resuscitation care** after **return of spontaneous circulation (ROSC)** from cardiac arrest.

Part 9: Medical

The chapters within the "Medical" standard are those on respiratory and cardiovascular emergencies; altered mental status, stroke, and headache; seizures and syncope; acute diabetic emergencies; allergic and anaphylactic reactions; toxicologic emergencies; abdominal, hematologic, gynecologic, genitourinary, and renal emergencies; and environmental, submersion (drowning and diving), and psychiatric emergencies.

What's New?

- Chapter 16, "Respiratory Emergencies," has been extensively revised and updated. Included are expanded information on **respiratory distress, respiratory failure,** and **respiratory arrest**; on forms of obstructive pulmonary disease: **asthma, emphysema,** and **chronic bronchitis**; on **pulmonary embolism, pulmonary edema,** and **cystic fibrosis**; and on the use of **metered-dose inhalers** and **small-volume nebulizers.**
- Chapter 17, "Cardiovascular Emergencies," features expanded information on **dangers of administering too much oxygen** and expanded information on evaluating **hypertension associated with a cardiac emergency**.
- Chapter 18, "Altered Mental Status, Stroke, and Headache" has been extensively revised and updated. New or expanded information is included on the **AHA Stroke Chain of Survival**; the **FAST mnemonic** (facial droop, arm drift, speech difficulty, time to call 911) for identifying a stroke; the **ischemic penumbra** (area of afflicted brain cells that can be restored to full function by prompt emergency care); new information on **atrial fibrillation** as a cause of stroke and on **atriovenous malformation (AVM),** a tangle of malformed vessels that can rupture and cause a stroke. There is expanded information on **transient ischemic attack (TIA)** and a new section on **cryptogenic stroke** (unidentifiable cause). New sections introduce two newer stroke screening tools: **MENDS (Miami Emergency Neurologic Deficit)** and **RACE (rapid arterial occlusion evaluation) scale** and associated information on **large vessel occlusion (LVO)** in addition to retaining information on the Los Angeles and Cincinnati stroke screening tools.
- Chapter 19, "Seizures and Syncope," includes information on differentiating a **primary seizure** (unprovoked, as from a condition like epilepsy) from a **secondary seizure** (provoked; caused by an insult to the body such as infection, drug withdrawal, brain disease, or other). New definitions of **prolonged seizure** and **status epilepticus** from the American Epilepsy Society are included, and there is an updated classification and discussion of **generalized seizures** and **partial seizures**.
- Chapter 20, "Acute Diabetic Emergencies," includes general updates throughout the chapter and a new section on **intranasal glucagon**.
- Chapter 21, "Allergic and Anaphylactic Reactions," has expanded information on the causes of **anaphylactic** and **anaphylactoid reactions**. There is new information on the use of **manual epinephrine injection** to control an anaphylactic reaction and a new section on **biphasic anaphylactic reactions** (that seem normalized but then return in life-threatening form).

- Chapter 22, "Toxicologic Emergencies," puts new emphasis on **opioid drug abuse and overdose** and on administration of **naloxone** to reverse an opioid overdose. Expanded information is included on **suicide bags** and **suicide by toxic gas inhalation**. There are new sections on the substances **methylenedioxymethamphetamine (MDMA)** and **tetrahydrocannabionl (THC).** There is also a new section on **cannabinoid hyperemesis syndrome**.
- Chapter 23, "Abdominal, Hematologic, Gynecologic, Genitourinary, and Renal Emergencies," introduces new sections on considerations regarding abdominal pain in **pediatric, geriatric, immunocompromised,** and **bariatric surgery patients**.
- Chapter 24, "Environmental Emergencies," introduces the concept of **two systems, behavioral and physiologic, to regulate body temperature**. There is new information on **immersion hypothermia** to include **cold shock response, cold incapacitation,** and **nonfreezing cold injury.** A new term, **freezing cold injury** replaces the former term *local cold injury.* There is a new section on **exercise-associated hyponatremia (EAH).**
- Chapter 25, "Submersion Incidents: Drowning and Diving Emergencies," has general updates throughout but no major changes from the prior edition.
- Chapter 26, "Psychiatric Emergencies," (formerly titled "Behavioral Emergencies") has been extensively revised to emphasize **distinguishing psychiatric from physical causes** of behavior changes, including a **mental status exam** and a new section, **"Mini Assessment for Common Psychiatric Emergencies."** There are updated definitions, based on the *Diagnostic and Statistical Manual (DSM-5),* and **detailed discussion of psychiatric problems** including anxiety; bipolar disorder; depression; neurocognitive disorders; schizophrenia spectrum and other psychotic disorders; substance abuse and addictive disorders; trauma/stressor-related disorders; and extrapyramidal symptoms (involving involuntary movement). There is **expanded discussion of violence** (including suicide and violence to others), and there is an expanded and updated dicsussion of **principles, techniques, and legal considerations** in dealing with psychiatric emergencies.

Part 10: Trauma

The chapters within the "Trauma" standard include a trauma overview and chapters on bleeding and soft tissue trauma; burns; musculoskeletal trauma and nontraumatic fractures; trauma to the head, spinal column and spinal cord, eye, face, neck and chest; abdominal and genitourinary trauma; multisystem trauma; and trauma in special patient populations.
The chapters in the Trauma Section of this edition include many new photos of exceptional quality illustrating types of trauma and trauma care techniques.

What's New?

- Chapter 27, "Trauma Overview: The Trauma Patient and the Trauma System," is largely unchanged from the prior edition but, in the Vehicle Collisions section, includes added information about **vehicle telemetry data predictive of injury**.
- Chapter 28, "Bleeding and Soft Tissue Trauma," newly includes **The Prehospital External Hemorrhage Control Protocol** from the American College of Surgeons Committee on Trauma. There is new and expanded information on **tourniquet application** and **hemostatic impregnated gauze dressings**. There is a new section on **junctional bleeding control** (where extremities or the head meet torso or core body) and expanded information on emergency care for **nosebleed**.
- Chapter 29, "Burns," includes new information on **fluid shifts from burns causing edema that occludes the airway**. There is a new section, "**Toxin-Induced Lung Injury,"** and the **Lund-Browder burn classification chart** is newly included. The chapter includes expanded information on **burn dressings**, **burn center referral criteria,** and treatment of **chemical burns.**
- Chapter 30, "Musculoskeletal Trauma and Nontraumatic Fractures," has expanded information on assessment and care of **pelvic fracture** and new information on use of the **full-body vacuum mattress as a full-body splint.** Information on the pneumatic antishock garment (**PASG**) has been **deleted** from the chapter as this device is no longer recommended.
- Chapter 31, "Head Trauma," includes a new discussion of the pathophysiology of **primary brain injury, secondary brain injury,** and **brain herniation**. There is new emphasis on **spine motion restriction** (rather than stabilizaiton or immobilization) and expanded information on **establishing and maintaining adequate breathing in head trauma**.
- Chapter 32, "Spinal Trauma and Spine Motion Restriction," (formerly titled Spinal Column and Spinal Cord Trauma") reflects a **critical change in care for spinal trauma: spine motion restriction** rather than immobilization. (This concept is discussed in some prior chapters, but the principal discussion is presented in this chapter.) The chapter recognizes that the neck and spine cannot truly be immobilized and that evidence has shown that immobilization can actually worsen an injury. Use of soft or rigid cervical collars (no longer called cervical spine immobilization collars) to remind the patient to restrict head motion as well as techniques of spine motion restriction by EMTS as well as self-restriction by the patient are discussed. **The emphasis on spine motion restriction rather than immobiliation is a major change throughout the text whenever spinal (column or cord) injury is suspected or possible.**
  Photo sequences in Chapter 32, many new to this edition, clearly illustrate techniques of assessment for spinal injury and techniques of spine motion restriction for supine, ambulatory, and seated patients—including self-extrication techniques and traditional techniques of extrication with a Kendrick Extrication Device and rapid extrication from a vehicle.
- Chapter 33, "Eye, Face, and Neck Trauma," now includes emphasis on **spine motion restriction** and includes a new section on **corneal injury**.
- Chapter 34, "Chest Trauma," introduces a new concept: **the cardiac box** – the rectangular area of the anterior chest to which any penetrating or blunt injury increases the likelihood of cardiac or great vessel injury. There is updated information on care of an **impaled object**, emphasis on **spine motion restriction** (noting that immobilizing a patient to a hard board can impede chest excursion), and expanded information on use of a **commercial vented occlusive dressing** such as Asherman, Halo, or Bolin.

- Chapter 35, "Abdominal and Genitourinary Trauma," now emphasizes **spine motion restriction** in care of the abdominal trauma patient.
- Chapter 36, "Multisystem Trauma and Trauma in Special Patient Populations," includes expanded information on assessment of **trauma in a pregnant patient**, new information on **cervical spine injury in the pediatric patient**, and emphasis on **spine motion restriction**.

Part 11: Special Patient Populations

The chapters that fall under the "Special Patient Populations" standard are chapters on obstetrics and newborn care, pediatrics, geriatrics, and patients with special challenges.

What's New?

- Chapter 37, "Obstetrics and Care of the Newborn," has extensive revisions and updates throughout. There is new and expanded information on the effects of **abruptio placentae** on mother and fetus; **hypertensive emergencies**; assessing **contractions;** assessment for **prehospital delivery** and **delivery at the scene**; benefits of **delayed cord clamping; abnormal deliveries;** types of **breech presentation** and **breech delivery**; and **shoulder dystocia**. Included are the **AHA guidelines for newborn care;** obtaining the **Apgar score;** and **meconium present at birth**. New sections have been added on the predelivery emergency **hyperemesis gravidarum** (extreme and prolonged morning sickness); **estimating gestational age based on fundal height; face, chin, brow, and compound presentations;** and a new list of **assessment triggers and immediate interventions.**
- Chapter 38, "Pediatrics," has a new section on **"Brief Resolved Unexplained Events" –** events in an infant or child that, though brief, concerned the parent or caregiver, such as a period of cyanosis or a change in breathing or level of consciousness. There is also a new discussion of **spine motion restriction in the pediatric patient.**
- Chapter 39, "Geriatrics," has a new section on "**Cognitive Impairment"** and a new discussion of **spine motion restriction in the geriatric patient.**
- Chapter 40, "Patients with Special Challenges," includes an extensive new section, **"Autism and EMS,**" based on facts for EMS personnel provided by the Autism Spectrum Disorder Foundation. There are extensive new sections on **"Human Trafficking"** and **"Domestic Violence**." The section on **ventricular assist devices (VADs)** has been extensively revised, and there is a new section, **"Vagus Nerve Stimulator"** about an implanted device found in some patients with seizure disorder.
- Chapter 41, "The Combat Veteran," has no significant changes from the prior edition.

Part 12: EMS Operations

The chapters within the "EMS Operations" standard are chapters on ambulance and air medical operations; gaining access and patient extrication; hazardous materials; multiple-casualty incidents and incident management; and EMS response to terrorist incidents.

- Chapter 42, "Ambulance Operations and Air Medical Rescue," includes two new sections: **"Culture of Safety in EMS"** (based on recommendations of the National Emergency Medical Services Advisory Council) and **"Crew Resource Management"** (based on recommendations of the International Association of Fire Chiefs).
- Chapter 43, "Gaining Access and Patient Extrication," has many updates and added details throughout the chapter and new information on **gaining access to a home through an unlocked upper story window**.
- Chapter 44, "Hazardous Materials," has revised sections on **safety data sheets (SDS)** [no longer called material safety data sheets (MSDS)]; the **2016 Emergency Response Guidebook**.; and **decontamination.** There is a new section. on the Wireless Information System for Emergency Responders **(WIZER) app** from the National Library of Medicine providing access to extensive medical information. There is also a new section on **"Criminal Use of Hazardous Materials"** that includes information on **clandestine drug labs**.
- Chapter 45, "Multiple-Casualty Incidents and Incident Management," provides a reference and URL/link to **training and certification in the incident command system, provided free of charge on the Federal Emergency Management Agency (FEMA) website**. A new section is included on the **SALT Field Triage System** formulated by the American College of Surgeons Committee on Trauma.
- Chapter 46, "EMS Response to Terrorist Incidents," has new information and/or new sections on **improvised explosive devices (IED); radiological exposure devices (RED); improvised nuclear devices (IND)' active shooter incidents** and the use of **tactical EMS**; and **cyberterrorism.**

We Want to Hear from You

Many of the best ideas for improving our text books and training for future EMTs come from the instructors and students who use our books and ancillary materials. If you have ideas to offer us or questions to ask, you can reach us at the addresses listed below.

Contact Joseph Mistovich at:
jjmistovich@ysu.edu
Visit the Brady website at:
http://www.bradybooks.com

Acknowledgments

We wish to thank the following groups of people for their assistance in developing the 11th Edition of *Prehospital Emergency Care*.

Medical Editor

Our special thanks to Howard A. Werman, MD, Professor and Vice Chair of Academic Affairs, Department of Emergency Medicine, The Ohio State University, Columbus, Ohio, and to Dr. Ashley Larrimore, MD, Assistant Professor and Medical Director, Center for EMS, Department of Emergency Medicine, The Ohio State University, Columbus, Ohio. Dr. Werman and Dr. Larrimore reviewed the entire manuscript to ensure that the highest degree of medical accuracy was attained. Their insight and expertise was invaluable to the development of the text.

Contributing Writers

We would like to express special appreciation to the following specialists who contributed to chapter development in the 11th Edition.

Tom Brazelton, MD, MPH, FAAP
Professor of Pediatrics
University of Wisconsin School of Medicine and Public Health
Madison, Wisconsin
Chapter 38 – Pediatrics

Benjamin J. Esposito, EMT-P
Lieutenant/Hazardous Materials Specialist
Youngstown Fire Department
Youngstown, Ohio
Chapter 2 – Workforce Safety and Wellness of the EMT
Chapter 43 – Gaining Access and Patient Extrication
Chapter 44 – Hazardous Materials
Chapter 45 – Multiple Casualty Incidents and Incident Command
Chapter 46 – EMS Response to Terrorist Incidents

Thomas Gifford, DO, MS, FACOEP
Director, Emergency Medicine Residency Program
St Elizabeth Boardman Hospital
Boardman, Ohio
Chapter 15 – Shock and Resuscitation
Chapter 17 – Cardiovascular Emergencies

Janet M. Gorsuch, RN, MS, CRNP
Nurse Practitioner Akron Children's Hospital
Boardman, OH
Chapter 38 – Pediatrics

Brandt S. Lange, BA, CEP/EMT-P
Engineer/Paramedic
Chandler Fire Department
Chandler, Arizona
Chapter 41 – The Combat Veteran

James D. Lange, PhD
Combat Medic – Vietnam (1967–1968)
Mesa, Arizona
Chapter 41 – The Combat Veteran

Matthew Ozanich, MHHS, NRP
Director of Pre-Hospital Care
Trumbull Memorial Hospital
Warren, Ohio
Chapter 38 – Pediatrics

Amanda L. Roby, MHHS, RRT, RPSGT
Assistant Professor, Director of Clinical Education for Respiratory Care and Polysomnography
Department of Health Professions
Youngstown State University
Youngstown, Ohio
Chapter 10 – Airway Management, Artificial Ventilation, and Oxygenation
Appendix 2 – Advanced Airway Management

Jessica Wallace, PhD, AT, ATC
Assistant Professor
Master of Athletic Training Program Director
Youngstown State University
Youngstown, Ohio
Chapter 32 – Spinal Injury and Spine Motion Restriction

Kristyn Woodward, MSW, LISW-S
Outpatient Mental Health Clinician
PsyCare
Boardman, Ohio
Chapter 26 – Psychiatric Emergencies

Mary Yacovone, MEd, RRT
Associate Professor, Director of Respiratory Care
Department of Health Professions
Youngstown State University
Youngstown, Ohio
Chapter 16 – Respiratory Emergencies
Appendix 2 – Advanced Airway Management

Reviewers

The following reviewers of 11th Edition material provided invaluable feedback and suggestions.

Joey Brand
Paramedic Instructor
Atlanta Fire Department
Atlanta, GA

Amy Eisenhauer
EMT
RWJBH
New Jersey

Gregory Helmuth
Emergency Medical Services, Program Advisor
Hawkeye Community College
Waterloo, IA

David J. Kuchta, BSAS,RN, NRP
Emergency Medical Technology Program Director
Northwest Mississippi Community College
Senatobia, Mississippi

Kelly Miyashiro, EMT
Senior EMS Instructor
American Medical Response
Tukwila, WA

Aaron Nafziger, BS, NRP
Higher-Ed Instructor
Hewitt Trussville High School
Trussville, AL

Jack Pearsull, BA
Emergency Medical Services, Instructor
Massasoit Community College
Brockton, MA

Timothy Steele, PhD, MT (ASCP)
Microbiology and Immunology, Professor and Chair
Des Moines University
Des Moines, IA

Greg West, MEd, EMT I/C
Human Services and Emergency Response Pathways, Instructor
Northshore Community College
Danvers, MA

Photo Acknowledgments

All photographs not credited adjacent to the photograph were photographed on assignment for Brady/Pearson.

Organizations

We wish to thank the following organizations for their assistance in creating the photo program for this edition:

Suncoast Technical College (Sarasota, FL)
Scott Kennedy, ARNP – Health and Public Safety Program Mgr.
Brian Kehoe, EMT-P – EMS Program Director.
Mark Tuttle, EMT-P – Human Simulation Coordinator/Lead EMT Instructor.
Dustin Martinez, EMT-P – EMT Instructor

Sarasota County Fire Department (Sarasota, FL)
Chief Michael Regnier

COMPANIES:
We wish to thanks the following companies for their assistance in providing medical devices for the photo program for this project:
Jake Nyhart, Account Manager, Phillips North America
Rob Williams, Cardiac Science

PHOTO COORDINATORS/ SUBJECT MATTER EXPERTS

Thanks to the following for valuable assistance directing the medical accuracy of the shoots and coordinating models, props, and locations for our photos:

Rodney Van Orsdol, EMT-P
Dustin Martinez, EMT-P
Skippi Farley, EMT-P
Mark Tuttle, EMT-P

MODELS

Thanks to the following people who portrayed patients and EMS providers:

Amber Lee Albritton
Sarah Albritton
Cody Alsip
Monica Amaya
Karen Arango
Eric Austin
Timothy Scott Ball
Stephen E. Bledsoe, II
Jeffrey Bolger
Addyson Brown
Aubrey Brown
Ava Brown
Jude Brown
Korrell Butler
Jonathan Chu
Omarrie Cook
Fay Donaldson
Skippi Farley
Ryan Felts
Isaac Ferrell
Landon Ginter
Dustin Anthony Martinez
Dwayne McKeaver
Britta Saemann
Lisa Sedillo
Brandon Smith
Odis P. Smith
Taylor Smith
Jordan Tuttle
Mark Tuttle
Ashley Uhran
Rodney VanOrsdol
Deborah Williams

Photographers:
Michal Heron
Maria Lyle, Maria Lyle Photography
Ed Effron
Kevin Link

Photographers Assistants:
Monica Amaya
Karen Arango
Eric Austin
Mark Burelle

About the Authors

Joseph J. Mistovich, MEd, NRP

Joseph Mistovich is Chairperson of the Department of Health Professions and a Professor at Youngstown State University in Youngstown, Ohio. He has more than 33 years of experience as an educator in emergency medical services.

Mr. Mistovich received his Master of Education degree in Community Health Education from Kent State University in 1988. He completed a Bachelor of Science in Applied Science degree with a major in Allied Health in 1985, and an Associate in Applied Science degree in Emergency Medical Technology in 1982 from Youngstown State University.

Mr. Mistovich is an author or coauthor of numerous EMS books and journal articles and is a frequent presenter at national and state EMS conferences.

Keith J. Karren, PhD, EMT-B

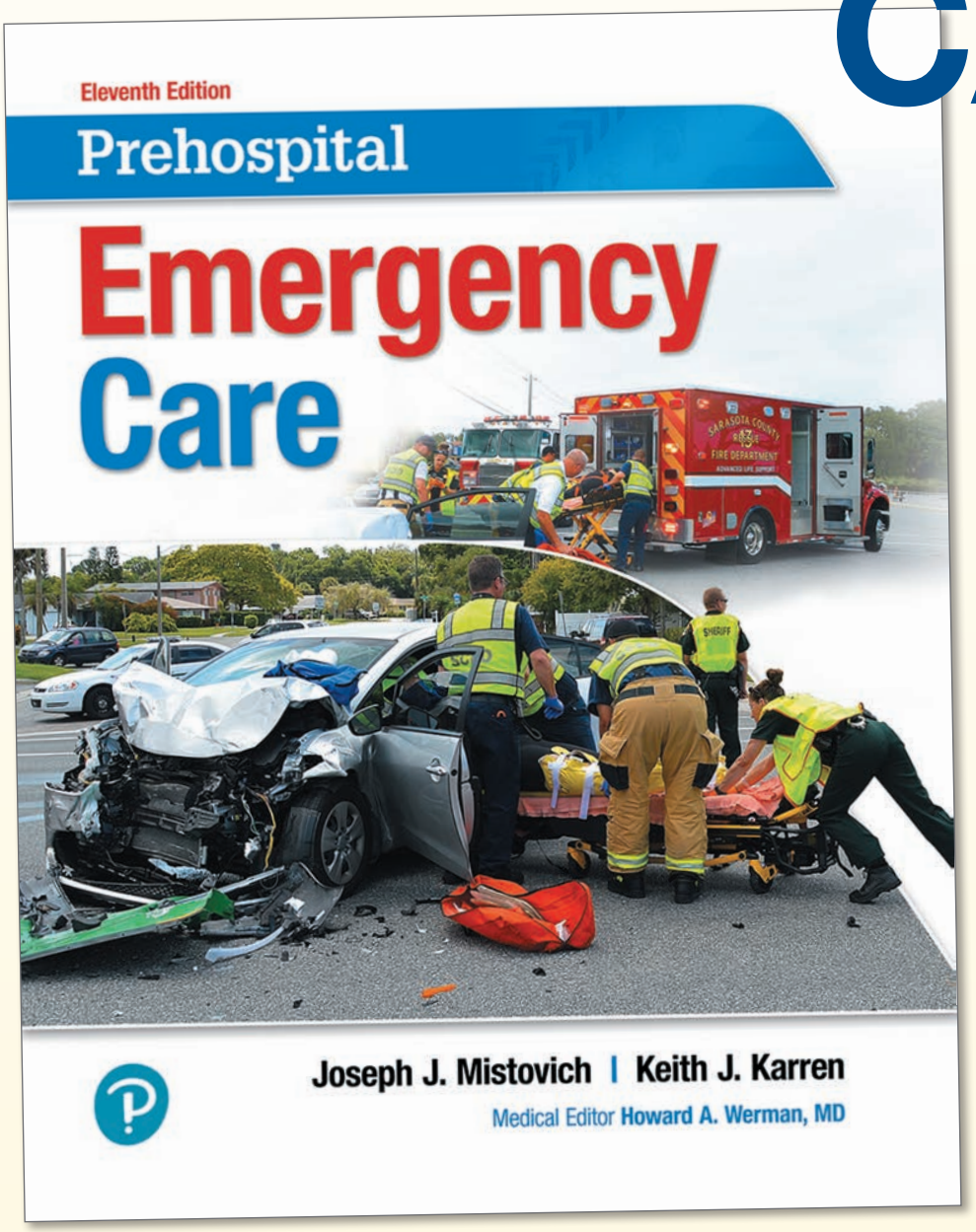
Keith J. Karren is Professor Emeritus and former Chair of the Department of Health Science at Brigham Young University in Provo, Utah. He has been a professional Health Science and EMS educator and author for 40 years. Dr. Karren received his Bachelor of Science and Master of Science degrees from Brigham Young University in 1969 and 1970 and his PhD in Health Science from Oregon State University in 1975. Dr. Karren was one of the earliest-certified EMTs in Utah and helped found SAVERS, a community volunteer EMS ambulance association in Utah. Dr. Karren co-founded the Prehospital Emergency Care and Crisis Intervention Conference, held annually in Salt Lake City for 36 years, one of the premier EMS conferences in North America. Dr. Karren is the author or coauthor of numerous books on prehospital emergency care and health, including *First Aid for Colleges and Universities*, *First Responder: A Skills Approach* and *Mind/Body Health*.

This page intentionally left blank

Welcome to

PREHOSPITAL EMERGENCY CARE

11th Edition



A Guide to Key Features

Standards and Competencies

Listed at the opening of each chapter is the Education Standard (or Standards) around which the chapter is written.

Also listed is the Competency (or Competencies) that identifies fundamental knowledge as well as patient assessment and management skills for the chapter.

Objectives

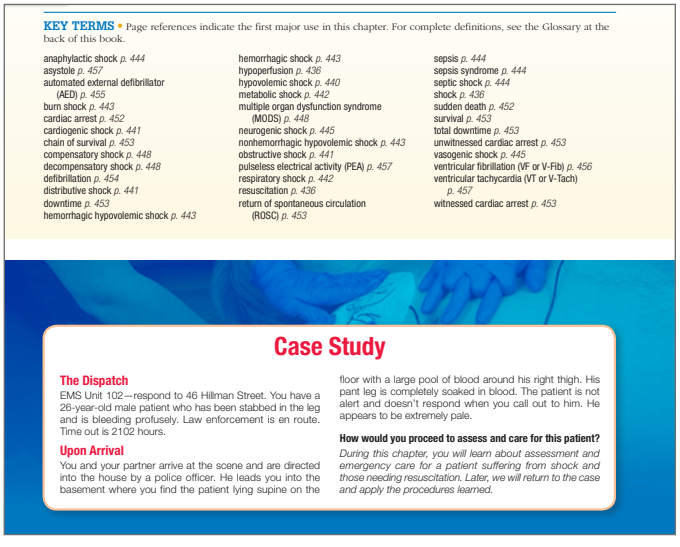
Objectives form the basis of each chapter and were developed around the Education Standards and Instructional Guidelines.

Key Terms

Page numbers identify where each key term first appears in the chapter.

Case Study and Follow-Up

Each chapter opens with a case study relevant to the chapter topic. The case draws students into the subject and creates a link between the text and real-life situations and experiences.



KEY TERMS • Page references indicate the first major use in this chapter. For complete definitions, see the Glossary at the back of this book.

anaphylactic shock *p. 444*
asystole *p. 457*
automated external defibrillator (AED) *p. 455*
burn shock *p. 443*
cardiac arrest *p. 452*
cardiogenic shock *p. 441*
chain of survival *p. 453*
compensatory shock *p. 448*
decompensatory shock *p. 448*
defibrillation *p. 454*
distributive shock *p. 441*
downtime *p. 453*
hemorrhagic hypovolemic shock *p. 443*
hemorrhagic shock *p. 443*
hypoperfusion *p. 436*
hypovolemic shock *p. 440*
metabolic shock *p. 442*
multiple organ dysfunction syndrome (MODS) *p. 448*
neurogenic shock *p. 445*
nonhemorrhagic hypovolemic shock *p. 443*
obstructive shock *p. 441*
pulseless electrical activity (PEA) *p. 457*
respiratory shock *p. 442*
resuscitation *p. 436*
return of spontaneous circulation (ROSC) *p. 453*
sepsis *p. 444*
sepsis syndrome *p. 444*
septic shock *p. 444*
shock *p. 436*
sudden death *p. 452*
survival *p. 453*
total downtime *p. 453*
unwitnessed cardiac arrest *p. 453*
vasogenic shock *p. 445*
ventricular fibrillation (VF or V-Fib) *p. 456*
ventricular tachycardia (VT or V-Tach) *p. 457*
witnessed cardiac arrest *p. 453*

Case Study

The Dispatch

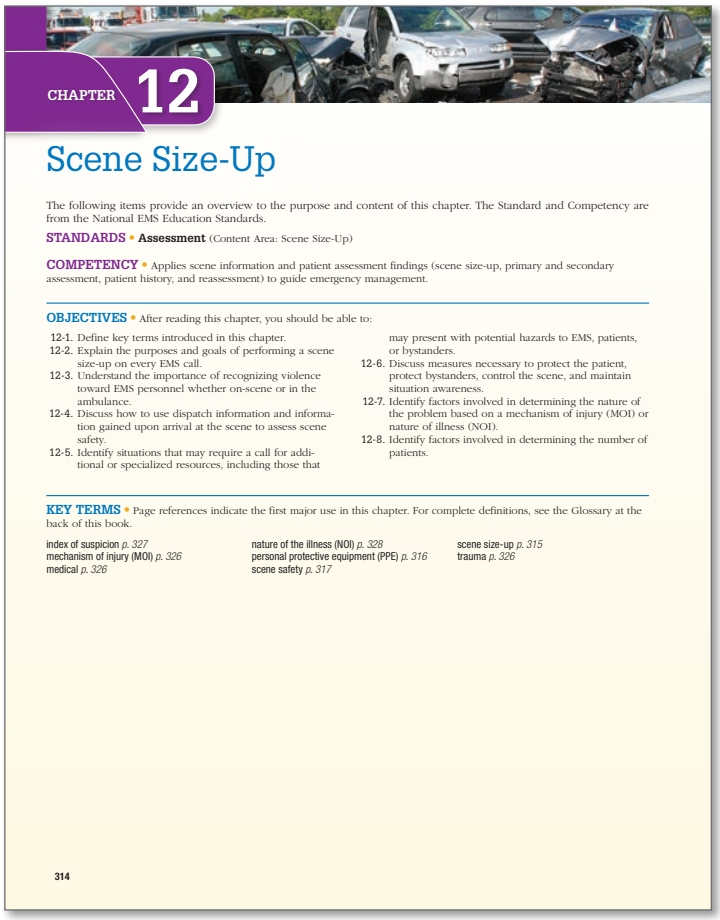
EMS Unit 102—respond to 46 Hillman Street. You have a 26-year-old male patient who has been stabbed in the leg and is bleeding profusely. Law enforcement is en route. Time out is 2102 hours.

Upon Arrival

You and your partner arrive at the scene and are directed into the house by a police officer. He leads you into the basement where you find the patient lying supine on the floor with a large pool of blood around his right thigh. His pant leg is completely soaked in blood. The patient is not alert and doesn't respond when you call out to him. He appears to be extremely pale.

How would you proceed to assess and care for this patient?

During this chapter, you will learn about assessment and emergency care for a patient suffering from shock and those needing resuscitation. Later, we will return to the case and apply the procedures learned.



CHAPTER 12

Scene Size-Up

The following items provide an overview to the purpose and content of this chapter. The Standard and Competency are from the National EMS Education Standards.

STANDARDS • **Assessment** (Content Area: Scene Size-Up)

COMPETENCY • Applies scene information and patient assessment findings (scene size-up, primary and secondary assessment, patient history, and reassessment) to guide emergency management.

OBJECTIVES • After reading this chapter, you should be able to:

12-1. Define key terms introduced in this chapter.
12-2. Explain the purposes and goals of performing a scene size-up on every EMS call.
12-3. Understand the importance of recognizing violence toward EMS personnel whether on-scene or in the ambulance.
12-4. Discuss how to use dispatch information and information gained upon arrival at the scene to assess scene safety.
12-5. Identify situations that may require a call for additional or specialized resources, including those that may present with potential hazards to EMS, patients, or bystanders.
12-6. Discuss measures necessary to protect the patient, protect bystanders, control the scene, and maintain situation awareness.
12-7. Identify factors involved in determining the nature of the problem based on a mechanism of injury (MOI) or nature of illness (NOI).
12-8. Identify factors involved in determining the number of patients.

KEY TERMS • Page references indicate the first major use in this chapter. For complete definitions, see the Glossary at the back of this book.

index of suspicion *p. 327*
mechanism of injury (MOI) *p. 326*
medical *p. 326*
nature of the illness (NOI) *p. 328*
personal protective equipment (PPE) *p. 316*
scene safety *p. 317*
scene size-up *p. 315*
trauma *p. 326*

314

Case Study Follow-Up

Scene Size-Up

You have been dispatched for a 26-year-old male patient who has been stabbed in the leg and is bleeding profusely. You are directed into the house by a police officer. You find the patient lying supine on the floor with a large pool of blood around his right thigh.

Primary Assessment

As you approach the patient, he is not alert and doesn't respond when you call his name. He also appears to be very pale. The patient moans when you pinch and twist his trapezius muscle. You open the airway using a jaw thrust and inspect inside the oral cavity. The mouth is clear of any obstructions. You assess the rate and depth of breathing by listening for air movement and watching the chest rise. The respirations are rapid and the tidal volume is adequate. ***(Tachypnea is a response by the body to supply more oxygen to the hypoxic cells and to compensate for an increasing metabolic acidosis from the shift from aerobic to anaerobic metabolism. The cells are likely hypoxic from a lack of available hemoglobin to transport the oxygen. As the cells become more hypoxic, the respiratory rate will continue to increase.)*** You instruct your partner to apply a nonrebreather mask at 15 lpm because shock and poor perfusion are suspected and to apply the pulse oximeter to attempt to get an SpO_2 reading. The radial pulse is barely palpable ***(The radial pulse is weak because of a decrease in blood pressure. Blood loss will cause a drop in preload, which will lower the stroke volume and cardiac output. If the cardiac output decreases, the blood pressure will decrease, resulting in weak or absent pulses. In addition, extreme peripheral vasoconstriction in the body's attempt to increase the blood pressure by increasing SVR will also contribute to a weak or absent peripheral pulse.)*** and the skin is pale, cool, and clammy. ***(Pale, cool and clammy skin results from the sympathetic response to constrict the peripheral vessels to raise the blood pressure. The skin becomes pale and cool as the red, warm blood is shunted to the core of the body. The hormones epinephrine and norepinephrine stimulate the alpha receptors in the vessels, causing a sustained vasoconstriction. The alpha 1 receptors in the sweat glands are also stimulated, causing them to produce and secrete sweat.)*** You quickly expose the leg and find a steady flow of blood coming from the wound. You apply direct pressure. You instruct your partner to cut the clothing to expose the remainder of the body.

Secondary Assessment

You recognize the signs the patient is exhibiting to be consistent with hypovolemic shock so you elect to do a rapid secondary assessment. You begin at the head and move systematically down to the toes inspecting and palpating for any other life-threatening injuries. You auscultate the breath sounds and find them to be equal and clear bilaterally. You log roll the patient to place him on a backboard. As you do so, you quickly cut away the clothing to the back and inspect and palpate for any other injuries. You place the patient on the backboard and cover him with blankets. While your partner prepares the patient for transport to the stretcher, you obtain a set of vital signs. His blood pressure is 72/58 mmHg. ***(The narrow pulse pressure of less than 30 mmHg is an indication that the cardiac output is dropping and the systemic vascular resistance is increasing. The cardiac output is dropping because of the volume loss, which decreases the preload and stroke volume. The systemic vascular resistance is increasing as the vessels constrict to increase the blood pressure. The systolic blood pressure is a measure of the cardiac output and the diastolic blood pressure is a measure of the systemic vascular resistance. As the cardiac output drops, the SBP decreases. As the SVR increases, the DBP increases. This creates the narrow pulse pressure as the difference between the SBP and DBP becomes smaller.)*** His heart rate is 132 bpm. ***($CO = HR \times SV$. When the stroke volume is decreasing because of a decreasing preload, one way to try to raise the cardiac output is to raise the heart rate. As the patient continues to bleed and the preload and stroke volume continue to decrease, the heart rate will continue to increase.)*** Respirations are 26/minute with a good tidal volume, and his skin is pale, cool, and clammy. Once the patient is secured to the stretcher, you quickly move him to the back of the ambulance and begin rapid transport to the level 1 trauma center.

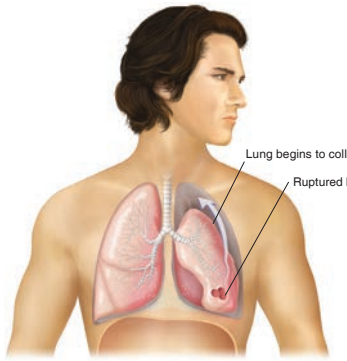
There was no one at the scene from whom you could have gathered a history. You did not note any medical identification items on his body. The patient remains responsive, but only to a painful stimulus. ***(The decrease in mental status is from inadequate perfusion of oxygenated blood to the brain. The brain cells are shifting to anaerobic metabolism and producing very small amount of ATP—not enough for all the brain cells to function normally. The result you see clinically is a decrease in mental status.)*** Thus, he is not able to provide any history.

Reassessment

En route to the hospital, you reassess the mental status, airway, ventilation, oxygenation, and circulation. You check the pressure dressing on the leg to be sure there is no additional bleeding. You obtain another set of vital signs. You contact the trauma center and provide a radio report of the assessment findings, your emergency care, and the ETA.

Upon arrival to the emergency department, the trauma surgeon meets you to bring the patient into the trauma bay. You provide an oral report and transfer the care of the patient. You then prepare your written report as your partner cleans and prepares the ambulance for another call.

The Case Study Follow-Up at the end of each chapter emphasizes key concepts learned and in-depth resolution. Case Study Follow-Ups in the clinical chapters include pathophysiology notes to explain the "why" of what you observe about the patient.



■ **FIGURE 16-8** A ruptured bleb, or weakened area of lung tissue, causes a spontaneous pneumothorax in which air enters the pleural cavity and travels upward, beginning the collapse of the lung from the top.

Assessment. A key finding in spontaneous pneumothorax is a sudden onset of shortness of breath without any evidence of trauma to the chest and with decreased breath sounds to one hemithorax upon assessment. Remember, if the patient is seated, the decreased breath sounds will be heard in the apex (top) of the lung because of gravity causing the air to rise. The signs and symptoms of a spontaneous pneumothorax follow:

- Sudden onset of shortness of breath
- Sudden onset of sharp chest pain or shoulder pain
- Decreased breath sounds to one side of the chest (most often heard first at the apex, or top, of lung)
- Subcutaneous emphysema (can be found)
- Tachypnea
- Diaphoresis
- Pallor
- Cyanosis (can be seen late and in a large or tension pneumothorax)
- SpO_2 <94%

ASSESSMENT TIPS

If a patient presents with a sudden onset of shortness of breath with decreased breath sounds to one side of the chest and no evidence of trauma, you should suspect a possible spontaneous pneumothorax. ■

Emergency Medical Care. Administer oxygen to maintain an SpO_2 of 94% or greater if the patient presents with signs of respiratory distress, chest pain, or any other indicators for oxygen administration. If inadequate breathing is present, provide positive pressure ventilation. Positive pressure ventilation in a patient suffering from a pneumothorax must be performed with great care because the pneumothorax could easily be converted into a tension pneumothorax (air entering the pleural cavity that cannot escape, eventually causing lung collapse). Use the most minimal tidal volume necessary to ventilate the patient effectively. If cyanosis, hypotension, significant resistance to ventilation, and severely decreased to absent breath sounds to one hemithorax occur, suspect a tension pneumothorax. The pulse oximeter reading also declines severely with the development of a tension pneumothorax. ALS can provide life-saving decompression of the chest in a tension pneumothorax; therefore, consider an ALS backup or rendezvous if a long transport time is expected. Follow your local protocol.

CPAP is contraindicated in a patient with a suspected pneumothorax regardless of the complaint of dyspnea and evidence of respiratory distress. The positive pressure can increase the size of the pneumothorax and worsen the hypoxia.

Hyperventilation Syndrome

Hyperventilation syndrome is frequently encountered in the prehospital setting. It is commonly associated with situations in which the patient is emotionally upset or excited. Patients suffering "panic attacks" also suffer from hyperventilation syndrome. Although hyperventilation syndrome is most often associated with an anxious patient, recognize that hyperventilation syndrome can be caused by a serious medical problem. Therefore, always consider an underlying medical cause of hyperventilation syndrome when assessing and providing emergency medi

It is extremely important to point out that sonnel often overlook significant and potent threatening conditions, especially pulmonary and myocardial infarction, because they becon on hyperventilation syndrome. That is why ca a patient as hyperventilation syndrome must with extreme caution and only after all other causes have been ruled out. It is also extreme tant to do a thorough assessment and reassessr stay vigilant for a deterioration in the patient's

Pathophysiology. The hyperventilation patient is often anxious and experiences th of not being able to catch his breath. The pa begins to breathe faster and deeper, causing the signs and symptoms of hyperventilation The true hyperventilation syndrome patient "blow off" excessive amounts of carbon dioxi tain level of carbon dioxide is necessary for to function normally. When too much carbo has been eliminated through rapid breathing, t begins to experience worsened signs and sym hyperventilation syndrome. The patient becor anxious because of the symptoms and breathes even faster. One result is that the amount of calcium in the

Assessment Tips

These suggestions offer clinical insights into patient assessment that EMTs learn over time through experience.

They enable the EMT to more accurately conduct an assessment and interpret the findings.

ASSESSMENT TIPS

Respiratory distress patients have an adequate chest rise (tidal volume) and an adequate respiratory rate. Because both the tidal volume and respiratory rate are adequate, the patient has adequate breathing and is in need of only supplemental oxygen. A patient in respiratory failure has inadequate tidal volume or an inadequate respiratory rate (too high or too low) or both. If either tidal volume or respiratory rate is inadequate, the respiratory status is inadequate and the patient needs immediate ventilation. Respiratory failure and respiratory arrest are treated the same way, with positive pressure ventilation and supplemental oxygen. ■

Pathophysiology Pearls

This feature offers snapshots of pathology considerations students will encounter in the field. It highlights the body processes that lead to medical conditions found in patients. Understanding body processes aids in making the right treatment decisions for them.

PATHOPHYSIOLOGY PEARLS

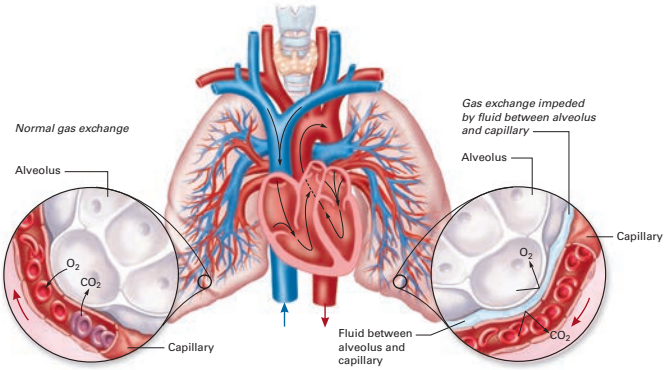
Hyperglycemic patients have too much glucose in the blood and not enough insulin. The cells in the body are starving, even though the blood glucose level can be extremely high because there is not enough insulin to move the glucose into the cells. At the same time, however, the brain is getting more than an adequate amount of glucose. ■

A Guide to Key Features

Photos and Drawn Art

Over one hundred new photos were shot for this edition of *Prehospital Emergency Care*. Many others were carefully researched from EMS and medical sources.

The photos work in combination with a unique, beautifully drawn art program to reinforce content coverage and add to text explanations.



■ **FIGURE 27-16** Rollover impacts. (© Ed Effron)

occupants who are not restrained to strike the mirror, posts, and doors, resulting in many injuries. Both head-on and lateral injury patterns occur.

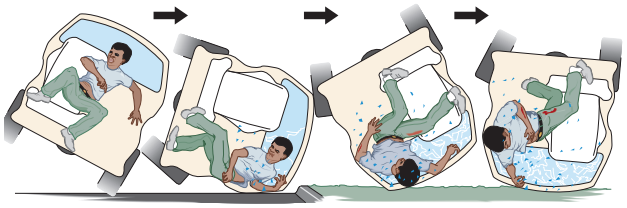
During a rollover, the vehicle hits the ground multiple times and in various places (Figure 27-16 ■). The occupant changes direction every time the vehicle does (Figure 27-17 ■). Vehicles with a high center of gravity, such as sports utility vehicles and vans, are more prone to rollovers. Every protruding object in the vehicle, including the rearview mirror, the headrest, and the door handles, becomes a potentially lethal object.

Although a specific pattern of injury is impossible to predict in a rollover, there are a few common characteristics. First, multiple systems injury is common. Second, ejection is common if the occupant was not restrained. Finally, crushing injuries to ejected occupants are common. Following the laws of motion, if you go straight through the windshield into the ditch, so does your vehicle, right into the ditch on top of you. Sometimes patients are thrown into other lanes of traffic too fast for oncoming vehicles to avoid.

Vehicle-Pedestrian Collision

When a vehicle hits a pedestrian, the extent of injury depends on how fast the vehicle was going, what part of the pedestrian's body was hit, how far the pedestrian was thrown, the surface the pedestrian landed on, and the body part that first struck the ground. The patterns of injury are likely to be different in children than in adults. This is because adults are larger and have a different weight distribution. Also, children and adults react to an impending collision differently.

A child who is about to be hit by a vehicle—whether the child is walking or riding a bicycle—generally turns toward the oncoming vehicle, so injuries from the impact are generally to the front of the body. A common pattern in a child struck by an auto is the combination of injuries



■ **FIGURE 27-17** In a rollover of an unrestrained occupant, impact to the body is difficult to predict and commonly results in multiple system injury.

Tables

A variety of tables highlight, summarize, and compare information.

TABLE 16-2 Categorization, Assessment, and Management of a Respiratory Disturbance

Category	Assessment	Emergency Care
Respiratory Distress	Adequate tidal volume and adequate respiratory rate that produces an adequate minute and alveolar ventilation.	Provide supplemental oxygen to maintain and SpO_2 >94%.
Respiratory Failure	Inadequate tidal volume, or an inadequate respiratory rate, or both.	Immediately begin positive pressure ventilation with a bag-valve-mask device with supplemental oxygen connected to the device.
Respiratory Arrest	No tidal volume and no respiratory rate. The patient may have agonal respirations in which there is a sudden gasping respiration with a long period of apnea.	Immediately begin positive pressure ventilation with a bag-valve-mask device with supplemental oxygen connected to the device.

Critical Findings

Critical Findings tables are unique to Chapter 13, Patient Assessment. They highlight types of trauma injuries, suggest possible findings, present injury possibilities based on this information, and summarize emergency care needed.

Critical (Unstable) Findings: The Posterior Body

Critical Finding:	Open wound to the posterior thorax
Possibility:	Sucking chest wound Lung injury (pneumothorax)
Emergency Care:	Occlude the open wound immediately with a gloved hand and then with a nonporous dressing or occlusive dressing taped on three sides. Rapid transport upon recognition. Consider ALS intercept. Establish an airway, begin positive pressure ventilation at 10–12/minute if the respiratory rate or tidal volume is inadequate, and administer oxygen. *Caution:* Aggressive PPV may worsen a lung injury.
Critical Finding:	Open wound with spurting or steadily flowing blood loss
Possibility:	Lacerated artery or vein
Emergency Care:	Apply direct pressure to the wound. Apply a pressure dressing if possible. Rapid transport. Administer oxygen.

Naloxone

Medication Name
Naloxone is the generic name. The trade name is Narcan.

Indications
Naloxone is indicated for patients with suspected or known opioid intoxication who have CNS depression with respiratory depression, hypotension or bradycardia.

Contraindication
The drug naloxone itself has not real effect on the body unless an opioid substance is present. Therefore, the only contraindication is a known hypersensitivity to naloxone.

Medication Form
The medication is a liquid form that can be administered by an intravenous, subcutaneous, intramuscular, intranasal, or endotracheal route. EMTs typically only administer naloxone by an intranasal route; however, some may use an intramuscular route also. A naloxone auto-injector is available. Follow your local protocol.

Dosage
The typical dose is 0.4 mg to 2 mg when given by various routes. When administered by an intranasal route, the typical dose is 2 mg–1 mg is administered via a mucosal atomization device (MAD) in each nostril.

Administration
1. Obtain an order from medical direction, either online or offline as per your local protocol.
2. Confirm the medication is naloxone.
3. Ensure the nostrils are clear of any obvious obstruction to intranasal administration. If blood, vomitus, or secretions are blocking the patency of the nasal passageway, suction prior to intranasal administration of the naloxone.
4. Consider restraining the patient prior to the administration of naloxone. Many patients suddenly become aggressive and combative upon returning to a conscious state after naloxone administration.
5. Draw up the naloxone if necessary using a needle and syringe. DO NOT use the needle for intranasal administration. Typically 1 mg is drawn up into the syringe.
6. Assemble the mucosal atomizer device to the syringe containing the naloxone.
7. With the patient in a supine position and the head slightly hyperextended, insert the naloxone firmly into one nostril.
8. Press the syringe plunger firmly and quickly until the 1 mg has been expelled into the nostril. (Follow your local protocol on dosage)
9. Repeat steps 5 through 8 using the opposite nostril.
10. Record the time, dose, and route of administration.

Actions
Naloxone is a pure opioid antagonist with a rapid onset of action. It competitively binds opioid receptors and can reverse all of the receptor actions of the opioid by effectively blocking the ability of the drug to bind with the receptor site.

Side Effects
Side effects may include:
- Acute opioid withdrawal
- Increased blood pressure
- Headache
- Musculoskeletal pain
- Nasal dryness, edema, congestion or inflammation

Reassessment
Following the administration of naloxone, it is important to reassess the airway, respirations, oxygenation, pulse, and blood pressure. You are primarily looking for reversal of any respiratory depression, hypotension and bradycardia. If the patient continues with respiratory depression, hypotension or bradycardia after the initial administration, it may be necessary to redoes the patient. Follow the same steps 5 through 9 until the desired effect if achieved. Your intention is not to completely reverse the mental status depression but to reverse any respiratory depression, hypotension, and bradycardia. The opioid the patient took may outlast the effects of the naloxone, which will cause the patient to deteriorate. If this occurs, it is necessary to redoes the patient.

■ **FIGURE 22-21** Naloxone.

Drug Profiles

Drug summaries provide medication name, indications, contraindications, medication form, dosage, administration, actions, side effects, and reassessment on medications that EMTs are permitted to administer.

Assessment Summary

Assessment Summaries reinforce assessment steps and processes as well as key assessment findings for specific medical and trauma emergencies.

Assessment Summary

RESPIRATORY DISTRESS

The following are findings that may be associated with breathing difficulty.

Scene Size-Up

Is breathing difficulty due to a medical or a traumatic cause? Look for evidence of:
- Mechanism of injury—collision, fall, guns, knives, bruising on chest
- Home or portable oxygen tanks or concentrators indicating chronic respiratory problems
- Alcohol or food that may indicate choking

Primary Assessment

General Impression

Position of patient:
- Tripod
- Lying flat

Facial expression:
- Agitated or confused

Speech:
- Patient may gasp for breath between words.

Mental Status
- Alert to unresponsive
- Restlessness
- Agitation
- Disorientation

Airway
- Inspect for incomplete or partial obstruction
- Crowing and stridor (indicate partial obstruction)
- Gurgling (indicates fluid in the airway; suction required)

Breathing
- Signs of inadequate breathing, including poor chest rise and fall, poor volume heard and felt, diminished or absent breath sounds
- Wheezing heard on auscultation

A Guide to Key Features

Emergency Care Protocol

Emergency Care Protocols provide concise summaries of emergency care steps to be taken in medical and trauma emergencies.

Emergency Care Protocol

STROKE

1. Establish and maintain an open airway. Insert a nasopharyngeal or oropharyngeal airway if the patient is unresponsive.
2. Suction secretions as necessary.
3. If breathing is inadequate, provide positive pressure ventilation with supplemental oxygen at a minimum rate of 10–12 ventilations/minute for an adult and 12–20 ventilations/minute for an infant or child.
4. If the SpO_2 reading is less than 94%, the patient complains of dyspnea, or signs and symptoms of hypoxia, heart failure, or shock are present, initiate oxygen by nasal cannula at 2 lpm and titrate until you reach and SpO_2 of 94% or greater. High-concentration oxygen is no longer considered routine for the stroke patient unless severe signs of hypoxia are present. Always follow your local protocols.
5. Place the patient in a lateral recumbent position if unresponsive and if no spinal injury is suspected. If responsive and no spinal injury is suspected, elevate the head no greater than 30 degrees.
6. Obtain a blood glucose reading if your protocol permits.
7. Transport.
8. Perform a reassessment every 5 minutes.

FIGURE 18-14B Emergency care protocol: stroke.

Emergency Care Algorithm

Emergency Care Algorithm — RESPIRATORY DISTRESS/FAILURE/ARREST

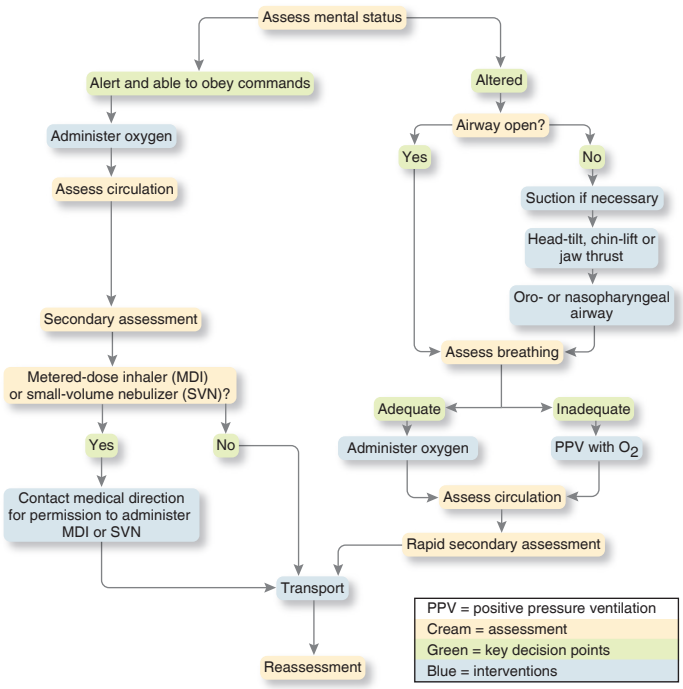


FIGURE 16-18 Emergency care algorithm: respiratory distress/failure/arrest.

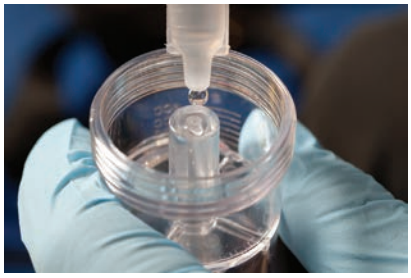
Emergency Care Algorithm

Emergency Care Algorithms are graphic pathways that visually summarize assessment and care steps for students.

EMT SKILLS 16-4 Administering Nebulized Medications

■ 16-4A Complete the primary assessment and assess the patient's pulse rate and breath sounds.

■ 16-4B Select the correct medication and consult with medical direction for an order to administer the medication.



■ 16-4C Add the medication to the nebulizer chamber.

■ 16-4E Coach the patient to inhale the nebulized medication from the mouthpiece.

EMT SKILLS 28-2 Application of a Tourniquet

■ 28-2A First attempt to control bleeding by direct pressure.

■ 28-2B If direct pressure is ineffective, apply direct pressure over a thick dressing while preparing the tourniquet.

■ 28-2C Apply the tourniquet proximal to the wound but not over a joint.

■ 28-2D Pack large, gaping wounds with sterile gauze and apply direct pressure. Tighten the tourniquet to the extent necessary to stop the bleeding. Write the time of tourniquet application on tape and apply it to the tourniquet, leaving the tourniquet exposed to view, and notify the receiving facility that a tourniquet has been applied. Continuously reassess the wound for recurrent bleeding. Do not loosen or remove the tourniquet unless directed to do so by medical direction or local protocol.

EMT Skills

Located at the end of chapters before review material, EMT Skills present step-by-step skill performance procedures for easy reference.

A Guide to Key Features

Chapter Review

SUMMARY

Respiratory emergencies can range from a patient experiencing respiratory distress to a patient who is in respiratory arrest. It is imperative to effectively assess the patient to determine if the condition is respiratory distress, respiratory failure, or respiratory arrest. The patient with breathing difficulty who is in respiratory distress can compensate for the disturbance and needs supplemental oxygen to improve his oxygenation status. The patient in respiratory failure, as the name implies, has failed to continue to meet the metabolic demands of the body, and the respiratory rate or tidal volume is no longer adequate. This patient needs immediate ventilation with a bag-valve mask or other ventilation device and supplemental oxygen. A patient in respiratory arrest is no longer breathing and needs immediate positive pressure ventilation.

A patient in respiratory distress who has a history of asthma, emphysema, or chronic bronchitis might have a MDI or home nebulizer unit that delivers a beta 2-specific drug. If so, you can assist the patient in using the device to relieve the bronchoconstriction that is impeding airflow into the alveoli.

Infants, children, and geriatric patients can present differently than adults when experiencing a respiratory emergency. Quick intervention is necessary because the most common cause of cardiac arrest in pediatric patients is from an airway or respiratory compromise, and geriatric patients can rapidly deteriorate because of poor compensatory mechanisms.

Case Study Follow-Up

Scene Size-Up

You have been dispatched to a 31-year-old female patient complaining of difficulty in breathing. A man nervously greets you at the curb as you gather your equipment. He indicates that the patient is his wife, Anna Sanders, who is having a hard time breathing. You are led up to the third floor of an apartment complex. You do not note any possible hazards, but are looking at how difficult the extrication might be. Upon walking into the apartment, you note a young female patient sitting in a tripod position next to the kitchen table.

Primary Assessment

As you start to introduce yourself, the patient begins to speak, gasping for her breath after each word. With great difficulty and gasps between the words she states: "I—can't—breathe." ***(Based on the asthma severity scale, the ability to speak with only words, not sentences or phrases, is an indication of a severe acute attack.)***

Based on Mrs. Sanders's facial expression and posture, she appears to be in a great deal of distress. Her airway is open and her breathing is rapid and labored at a rate of 34 per minute. ***(The increase in respiratory rate is likely due to a decrease in tidal volume and alveolar ventilation and is an attempt to compensate by moving more air in and out of the respiratory tract. However, this rate increase may increase minute ventilation but not improve alveolar ventilation—the amount of air being moved in and out of the alveoli. The latter is what determines oxygenation of the blood.)***

There are audible wheezes when Mrs. Sanders exhales. ***(Wheezing is an indication of turbulent airflow in the bronchi and bronchioles. This can be caused by constriction of the bronchi and bronchiole smooth muscle and inflammation of the lining of the lower airways.)*** The SpO_2 is 78% on room air. ***(An SpO_2 of 78% on room air is a clear indication of hypoxemia from inadequate alveolar ventilation.)*** Thus, you apply a nasal cannula at 2 lpm.

Her radial pulse is about 110 per minute. ***(Tachycardia is a sympathetic response associated with fear, anxiety, and hypoxemia in respiratory distress. When the brain becomes hypoxic, it attempts to increase the blood pressure to increase the blood flow of oxygenated blood to the brain. By increasing the heart rate, the body tries to increase cardiac output, thereby increasing blood pressure.)***

The skin is moist and slightly pale. ***(The sympathetic response to hypoxia and the need to increase blood pressure to increase blood flow to the brain causes an increase in the systemic vascular resistance. By increasing SVR, the body attempts to increase BP and better perfuse the brain with oxygenated blood.)***

You recognize the patient as a priority and signal your partner to get the stretcher while you continue with the secondary assessment.

Secondary Assessment

You begin to evaluate the difficulty in breathing using the OPQRST mnemonic. You ask Anna questions she can answer with a nod or a shake of her head to reduce her need to respond by speaking. Some questions you direct to her husband. You ascertain that the breathing difficulty began gradually about 2 hours ago and got progressively worse. She is unable to lie down because this causes her breathing to get much worse, although sitting up is not much better. She has had similar episodes in the past, but none seem to have been this severe. On a scale of 1 to 10, Mrs. Sanders indicates that her difficulty in breathing is about an 8 or 9.

You continue to obtain a history. The primary symptom is severe difficulty in breathing. Mrs. Sanders has an allergy to penicillin. When asked about medications that she takes, Mr. Sanders brings you a prescription of albuterol in a MDI. ***(Albuterol is a short acting beta 2 agonist—SABA. This is an indication that the patient has a history of a reactive airway disorder such as asthma.)*** She is on no other medication. When asked if she has taken any of the albuterol, her husband says, "She took one puff about 15 minutes ago." She has a past medical history of asthma and suffers these attacks maybe once every four or five months. She has had nothing to eat for about 3 hours, but she drank a small glass of orange juice about an hour ago. She was cleaning the kitchen when the episode began.

You quickly perform a physical exam. You assess her neck for jugular vein distention. Inspection of her chest and abdomen reveals significant use of the abdominal muscles when exhaling. ***(Constricted and inflamed lower airways cause an increase in airway resistance. This resistance makes it hard to get air into the alveoli and hard for air to escape the alveoli. The patient begins to trap air. When this occurs, the patient contracts the abdominal muscles on exhalation to push the internal organs upward against the diaphragm to push it up higher into the chest cavity. By doing so, it may increase the positive pressure generated on exhalation and force more air to be exhaled against the higher airway pressure.)***

The breath sounds are diminished bilaterally and you hear wheezing even without using your stethoscope. ***(Diminished breath sounds with diffuse wheezing in the larger airways indicates that the more distal and terminal bronchioles are maximally constricted and have little-to-no air movement going to the alveoli for gas exchange.)*** Her fingertips are slightly cyanotic. ***(Cyanosis is from a deficiency in oxygen attaching to the hemoglobin in the blood. This is a late but clear sign of hypoxemia.)*** You assess the baseline vital signs and find a blood pressure of 134/86; pulse of 118 per minute and regular; respirations at 32 per minute and labored with audible wheezing; the skin is moist and slightly pale. Her SpO_2 is 78% prior to oxygen administration.

IN REVIEW

1. List the major signs and symptoms of breathing difficulty.
2. List the signs of adequate breathing.
3. List the signs of inadequate breathing.
4. List the steps of emergency care for a patient who is exhibiting signs and symptoms of breathing difficulty but is breathing adequately (respiratory distress).
5. List the steps of emergency care for a patient who is in respiratory failure.
6. List the signs of adequate positive pressure ventilation and the steps to take if ventilation is inadequate.
7. Explain the steps to administer a medication by MDI and by SVN.
8. List the indications and contraindications for the use of a short acting beta 2-agonist drug.
9. Describe the early signs of breathing difficulty in the infant or child; list the signs of inadequate breathing and respiratory failure in the infant or child.
10. Explain how to distinguish between airway obstruction in the infant or child patient caused by disease and airway obstruction caused by a foreign body; explain how treatment differs for the two types of airway obstruction.

CRITICAL THINKING

You arrive on the scene and find a 72-year-old female patient sitting up in her recliner in the living room of her home. She looks fatigued and appears to be in severe respiratory distress. As you approach her, she appears pale and diaphoretic with circumoral cyanosis. Her head is bobbing with each breath. As you ask her name, she can barely say it. She is gasping with each breath she takes. Her respiratory rate is 36 per minute with a shallow tidal volume. Her radial pulse is weak and rapid. Her skin is pale, cool, and extremely moist. Her nail beds and fingertips are cyanotic. Her SpO_2 is 82%. Her blood pressure is 92/70 mmHg. She has a history of congestive heart failure, two previous heart attacks, and hypertension.

1. What immediate emergency care would you provide during the primary assessment?
2. What is the respiratory status of the patient?
3. How would you manage the respiratory status of the patient?
4. What would you expect to find upon auscultation of the lungs?
5. What areas of the lungs are most important to auscultate?
6. What is the most effective method to increase oxygenation in the patient?

Chapter Review

A Chapter Summary, Case Study Follow-Up that now includes *pathophysiology* notes (clinical chapters only) to explain the "why" of what you observe about a patient, In Review, and Critical Thinking questions comprise each chapter's review section, reinforcing the chapter's main points.

A Guide to the Student Workbook

The Student Workbook (ISBN 0134704568) is a selfinstructional guide, written to reinforce key concepts presented in the textbook. Every chapter includes five basic sections: Objectives, Key Ideas, Terms and Concepts, Content Review, and Case Study. Two additional sections appear as appropriate in many of the chapters. These special sections are Medical Terminology and Documentation Exercise. Medication Cards are also provided at the end of the Workbook.

Objectives

Form the basis of each chapter.

Key Ideas

Summarize the chapter's key concepts.

Terms and Concepts

Review major terms that are introduced in bold type in the textbook chapter and are listed and defined at the end of the book.

Content Review

Presents questions to review understanding of important information and concepts from the textbook chapter.

Case Study

Presents one or more realistic scenarios and requires students to apply chapter information to solving patient management problems.

Medical Terminology

Provides a chart of chapter-relevant medical terms that are frequently used in emergency care.

Documentation Exercise

Presents a real-life emergency-call scenario that is longer and more detailed than the Case Study scenarios. This exercise includes detailed vital signs and other physical exam and patient history information that would be gathered on such a call.

Medication Cards

Contain information about the medications that an EMT can administer or assist the patient in administering, with on-line or off-line approval from medical direction.

MyLab BRADY

www.mybradylab.com

What Is MyLab Brady?

Part of the world's leading collection of online homework, tutorial, and assessment products, Pearson **MyLab BRADY** is designed with a single purpose in mind: to improve the results of all higher education students, one student at a time.

With input from more than 11 million student users annually, **Pearson MyLab** creates online learning experiences that are truly personalized and continuously adaptive. **MyLab** reacts to how students are actually performing, offering data-driven guidance that helps them better absorb course material and understand difficult concepts.

Pearson also provides **Learning Management System (LMS) integration services** so you can easily access **MyLab BRADY** from Blackboard Learn, Brightspace by D2L, Canvas, or Moodle. From a single course section to delivery across an entire institution, we offer the integration, support, and training you need.

Understand How Your Students Make Decisions

Decision-Making Cases take EMT students through typical real-world scenarios. These branching cases give students practice with critical thinking, gathering patient data, and making decisions for care and treatment. Access all of the multimedia resources for your text in one place.

Multimedia Library

Each MyLab BRADY course comes with a Multimedia Library full of supporting visual and audio media, and other resources. Use it to build assignments, supplement your lectures, or give your students access to a wealth of related material. Support the learning needs of individuals and the entire class.

Results

Instructors can view students' results by chapter, outcome, homework, and more—to identify where more classroom time is needed. Digital access anytime, anywhere.

Pearson eText

The Pearson eText gives students access to their textbook anytime, anywhere, **on the device of their choice, including PC, tablet, or smartphone**. In addition to note taking, highlighting, and bookmarking, the Pearson eText offers interactive and sharing features. Rich media options let students watch lecture and example videos as they read or do their homework. Instructors can share their comments or highlights, and students can add their own, creating a tight community of learners in your class.

Where Can Instructors Get More Information?

Contact us at **www.mybradylab.com/contactus** for more information.

Give Students an On-the-Go Study Option

New! Complete Chapter Audio Presentations. Now students can listen to their Pearson eText anytime, anywhere—through their computer, tablet, or smartphone.

PART 1

Preparatory and Public Health

CHAPTER 1

Emergency Medical Care Systems, Research, and Public Health

The following items provide an overview to the purpose and content of this chapter. The Standard and Competency are from the National EMS Education Standards.

STANDARDS • **Preparatory** (Content Areas: EMS Systems; Research); Public Health

COMPETENCIES • Applies fundamental knowledge of the EMS system, safety and well-being of the EMT, and medical, legal, and ethical issues to the provision of emergency care.

Uses simple knowledge of the principles of illness and injury prevention to the provision of emergency care.

OBJECTIVES • After reading this chapter, you should be able to:

1-1. Define key terms introduced in this chapter.
1-2. Describe the key historical events that have shaped the development of the Emergency Medical Services (EMS) system.
1-3. Briefly explain each of the components of the Technical Assistance Program Assessment Standards.
1-4. Discuss the differences between 911 and non-911 EMS access systems, including the features and benefits of 911 systems.
1-5. Compare and contrast the scopes of practice for each of the nationally recognized EMS certification levels.
1-6. Explain the importance of the EMT's understanding of the health care resources available in the community.
1-7. Discuss the roles and responsibilities of the EMT and how the EMT can best meet these expectations.
1-8. Describe the expected professional attributes of the EMT.
1-9. Discuss the purposes of medical oversight, protocols, and standing orders within an EMS system.
1-10. Describe the purpose of, and the EMT's role in, quality improvement/continuous quality improvement programs in EMS.
1-11. Identify activities in EMS that pose a high risk of mistakes and injuries, and how to minimize these situations.
1-12. Discuss the steps of evidence-based decision making.
1-13. Explain the purpose of and limitations to evidence-based decision making in EMS.
1-14. Describe the relationship between EMS and public health, and list the ten greatest public health achievements.
1-15. Discuss what Mobile Integrated Healthcare and Community Paramedicine is, and why it has come to pass.

KEY TERMS • Page references indicate the first major use in this chapter. For complete definitions, see the Glossary at the back of this book.

Advanced Emergency Medical Technician (AEMT) *p. 6*
Americans with Disabilities Act (ADA) *p. 7*
Community Paramedicine (CP) *p. 16*
Emergency Medical Responder (EMR) *p. 5*
Emergency Medical Technician (EMT) *p. 5*
EMS system *p. 2*
evidence-based guidelines (EBG) *p. 14*
evidence-based medicine *p. 13*
direct medical oversight *p. 11*
indirect medical oversight *p. 11*
medical direction *p. 11*
medical director *p. 11*
medical oversight *p. 11*
Mobile Integrated Healthcare (MIH) *p. 16*
off-line medical direction *p. 12*
on-line medical direction *p. 11*
on-scene medical direction *p. 11*
Paramedic *p. 6*
prehospital care *p. 6*
protocols *p. 12*
quality improvement (QI) *p. 12*
standing orders *p. 12*

Case Study

The Dispatch

EMS Unit 121—respond to 10915 Pine Lake Road in Perry Township—you have an elderly male at that location—victim of a fall—Perry Township Fire Department has been notified and is en route—time out 1032 hours.

En Route

While you confirm the address with dispatch, your partner pulls out the county map. "I know that location," he says. "Yes, here. We need to head north on Lincoln." You pull your unit out of the garage. Your partner operates the emergency lights and sirens. Within 8 minutes, you turn onto Pine Lake Road and spot a police car and a fire truck.

Upon Arrival

You position your ambulance in the driveway of the residence to afford an easy exit. As you leave the unit, the police officer—who radioed for EMS help—tells you that a 65-year-old man fell about 30 feet down a very steep embankment behind his house. He's been at the bottom for about 30 minutes. The patient, Edgar Robinson, is conscious and is able to tell you that his right arm and leg are injured. The rescue squad from the fire department is preparing to rappel down the embankment to extricate the patient.

How would you proceed?

During this chapter, you will read about the roles and responsibilities of an EMT. Later, we will return to the case study and put in context some of the information you learned.

INTRODUCTION

One of the most critical health problems in the United States today is the sudden loss of life and disability caused by catastrophic accidents and illnesses. Every year, thousands of people in this country die or suffer permanent harm because of the lack of adequate and available Emergency Medical Services (EMS). As an Emergency Medical Technician (EMT), you can make a positive difference.

This course is designed to help you gain the knowledge, skills, and attitudes necessary to be a competent, productive, and valuable member of the EMS team. As you begin, your instructor will provide the necessary paperwork, describe the expectations for the course and the job, inform you of required or available immunizations, and outline your state and local provisions for certification as an EMT.

THE EMERGENCY MEDICAL SERVICES SYSTEM

In this section we will discuss the history of EMS and the standards for an EMS system that are recommended by the National Highway Safety System.

A Brief History

Emergency medical care has developed from the days when the local funeral home was the ambulance provider and patient care did not begin until arrival at the hospital. By contrast, the modern, sophisticated **EMS system** (Emergency Medical Services system) permits patient care to begin at the scene of the injury or illness, and EMS is part of a continuum of patient care that extends from the time of injury or illness until rehabilitation or discharge. Today, when a person becomes ill or suffers an injury, he has easy access to EMS by telephone, gets a prompt response, and can depend on getting high-quality prehospital emergency care from trained professionals.

What happens to an injured person before he reaches a hospital is of critical importance. Wars helped to teach us this lesson. During the Korean and Vietnam conflicts, for example, it became obvious that injured soldiers benefited from emergency care in the field prior to transport. This realization helped the civilian EMS system evolve from a mere provider of fast transport by poorly trained or untrained individuals who provided little or no care to a system in which highly trained EMS personnel provide professional care at the scene and en route to the hospital. We continue to learn about trauma care from the wars in Iraq and Afghanistan and we implement changes in EMS practice based on the outcomes of patients of those wars.

The modern EMS system has evolved from its beginnings in the 1960s when the President's Committee for Traffic Safety identified a need to reduce the injuries and deaths related to highway crashes. In 1966, the National Academy of Sciences National Research Council published a report entitled *Accidental Death and Disability: The Neglected Disease of Modern Society.* This report became known as the "white paper" that detailed the number of deaths and injuries related to traffic crashes in the United States. The "white paper" also identified severe deficiencies in the delivery of prehospital care in the United States and made recommendations intended

to change ambulance systems, training requirements, and the provision of prehospital care. The following are some of the significant developments that have had a profound effect on EMS systems:

- The Highway Safety Act of 1966 required each state to establish a highway safety program that met prescribed federal standards and included emergency services. The Department of Transportation, through its National Highway Traffic Safety Administration (NHTSA), took a leadership role in the development of EMS systems. An early focus was on improving the education of prehospital personnel. The development of national standard curricula was one initiative. The EMT programs of today gradually evolved from this charge and continue to use a national standard curriculum.
- The Emergency Medical Services System Act of 1973 provided access to millions of dollars of funding geared to EMS system planning and implementation, personnel availability, and training.
- In the 1960s, cardiopulmonary resuscitation (CPR) procedures were developed, and in the 1970s the American Heart Association began to teach CPR and basic life support to the public. Completion of a CPR course is now a prerequisite to the EMT course.
- In 1993, the National Registry of EMTs released the *National Emergency Medical Services Education and Practice Blueprint* which defines issues related to EMS training and education and is intended to guide the development of national training curricula.
- In 1996, the NHTSA published the *EMS Agenda for the Future* document with the intent of making EMS a greater component in the health care system in the United States. In 2000, a follow-up document, *The EMS Education Agenda for the Future: A Systems Approach,* was released to address the issue of consistency in the education, training, certification, and licensure of entry-level EMS personnel nationally.
- In 2005, the NHTSA and Health Resources and Services Administration published the *National EMS Core Content* which defines the domain of knowledge found in the *National EMS Scope of Practice Model*. It promotes universal knowledge and skills for EMS personnel.
- In 2006, the NHTSA published the *National EMS Scope of Practice Model,* which defines four levels of EMS licensure and the corresponding knowledge and skills necessary at each level. The levels of EMS licensure are discussed later in the chapter.
- In 2006, the Institute of Medicine report, *The Future of EMS Care: EMS at the Crossroads,* recommended that all state governments adopt a common scope of practice that allows for reciprocity between states, national accreditation for all paramedic programs, and national certification as a prerequisite for state licensure and local credentialing.
- The NHTSA's National EMS Education Standards outline the minimum terminal objectives for entry-level EMS personnel based on the *National EMS Scope of Practice Model*. The contents of this textbook are based on the National EMS Education Standards.

Advances are continually made in EMS design and response, equipment, research, and the education of EMTs. Many lives have been saved and unnecessary disabilities avoided because of these advances.

Technical Assistance Program Assessment Standards

Each state has control of its own EMS system design and regulations, independent of the federal government. However, the NHTSA provides a set of recommended standards called the "Technical Assistance Program Assessment Standards." A brief description of these standards follows. They are discussed in much more detail throughout this text and in your EMT course.

- **Regulation and policy.** Each state must have laws, regulations, policies, and procedures that govern its EMS system. A state-level EMS agency is also required to provide leadership to local jurisdictions.
- **Resource management.** Each state must have central control of EMS resources so that each locality and all patients have equal access to acceptable emergency care.
- **Human resources and training.** All personnel who staff ambulances and transport patients must be trained to at least the EMT level.
- **Transportation.** Patients must be provided with safe, reliable transportation by ground or air ambulance.
- **Facilities.** Each seriously ill or injured patient must be delivered in a timely manner to an appropriate medical facility.
- **Communications.** A system of communications must be in place to provide public access to the system and communication among the dispatcher, EMS personnel, and the hospital.
- **Public information and education.** EMS personnel should participate in programs designed to educate the public in the prevention of injuries and how to properly and appropriately access the EMS system.
- **Medical direction.** Each EMS system must have a physician as a medical director to provide medical oversight that includes overseeing patient care and delegating appropriate medical practices to EMTs and other EMS personnel.
- **Trauma systems.** Each state must develop a system of specialized care for trauma patients, including one or more trauma centers and rehabilitation programs, plus systems for assigning and transporting patients to those facilities.
- **Evaluation.** Each state must have a quality improvement system for the continual evaluation of and upgrades to the system.

More recently, the following elements of system design have been identified and should be included in an EMS system's goals (Gunderson, M. Principles of EMS System Design, *Emergency Medical Services: Clinical Practice and Systems Oversight*, Wiley, 2015):

- **Clinical quality**—The clinical performance of EMS personnel must be of a quality that achieves the set patient outcomes.
- **Service quality**—The performance of the system must be of a quality that meets the needs of the patients, public, and other communities of interest.
- **Economic efficiency**—A demand for high-quality services associated with a reasonable cost is economically more efficient.
- **Accountability**—Accountability ensures the system meets the needs of the patients and the public.
- **Improvement**—The EMS must continually strive to improve the system to deliver better care to the patients.
- **Resilience**—The system must adapt to changes that directly and indirectly affect its operations and stability.

Modern-day EMS systems typically provide the following services (Gunderson, M. Principles of EMS System Design, *Emergency Medical Services: Clinical Practice and Systems Oversight*, Wiley, 2015):

- Prevention and public education
- Triage
- Medical first response
- Ambulance response and transport
- Medical transportation
- Event coverage
- Disaster services
- Critical care transport
- Air medical transport
- Hazardous materials response medical support
- Tactical response medical support
- Community paramedicine

Access to the EMS System

The public can access two general EMS systems: 911 and non-911.

Often referred to as the universal number, 911 is the phone number used nationwide to access emergency services, including police, fire, and EMS. The most common 911 system is enhanced. An enhanced 911 system, called E-911, provides automatic number identification (ANI) and automatic location identification (ALI), which indicate the exact address and phone number from which the call is made. This information is automatically displayed on the computer screen of the call taker, even if the individual making the call hangs up. The main advantage of E-911 is that the address and phone number are automatically displayed, and an immediate response can be dispatched, even if the caller is unable to communicate effectively—for example, the caller has an injury or illness such as a stroke, the caller cannot recite his address in the confusion of the emergency, or the caller is a child who cannot tell the call taker the address.

Although exact procedures may vary, the basic process is the same. A public service answering point (PSAP) receives the calls, collects, verifies, and records the information about the emergency, decides which service must respond, and then facilitates alerting the necessary service (Figure 1-1 ■).

There are two main benefits of the 911 universal number:

- The PSAP is generally staffed by trained communications personnel. Many are specially trained as Emergency Medical Dispatchers (EMD) who not only take the call and facilitate the dispatch of emergency services, but also provide instructions for lifesaving emergency care, such as bleeding control or CPR. The caller or another person at the scene can then administer the instructions.
- The use of 911 reduces the time it takes the caller to access the emergency services system. The caller does not have to look up a ten-digit number to contact in the case of an emergency. The number is easy for young children to remember and dial. All three services—police, fire, and EMS—are accessible by dialing one number. Thus, all emergency resources can be dispatched simultaneously to a scene, such as a car crash that requires traffic control and investigation by the police, fire suppression and extrication by the fire service, and emergency medical care and transportation by EMS.

The Federal Communication Commission (FCC) currently estimates that wireless (cell) phones are responsible for placing approximately 70 percent of 911 calls, with the percentage increasing each year. Although wireless phones are an important tool in gaining access to public safety services in the event of an emergency, they also provide unique challenges to the PSAP and

■ **FIGURE 1-1** Communications play a vital role in the EMS system.

the information shared with the call taker. Because wireless service is mobile and not associated with one fixed address or geographic location, the cell site (tower) closest to the 911 caller is often the only location identifier. Also, the call can be erroneously sent to a PSAP that doesn't service that particular area if the cell site is close to a geographic boundary.

The FCC has adopted rules to improve the accuracy of location information provided to PSAPs by wireless technology companies. These rules include:

- **Basic 911.** The wireless service provider to transmit all calls to a PSAP regardless of whether the caller subscribes to the provider's service.
- **Phase I Enhanced 911.** The wireless service provider must provide the PSAP with the telephone number of the device placing the call and the location of the cell site or base station transmitting the call.
- **Phase II Enhanced 911.** The wireless service provider must provide the latitude and longitude of the caller. The information must be accurate within 50 to 300 meters, depending on the type of technology used.

Technology to track the exact location of cell phone calls through global-positioning-satellite (GPS) has been developed and is now used by many, but not all, EMS systems.

Voice over Internet Protocol (VoIP) services also present challenges to accessing 911 in an emergency. The FCC imposed requirements that VoIP providers must provide 911 service to all customers as a standard feature, obtain a physical location from the subscriber of where the service will be used, and transmit all 911 calls—including callback number and registered location—to the appropriate public service answering point.

Types of EMS Services

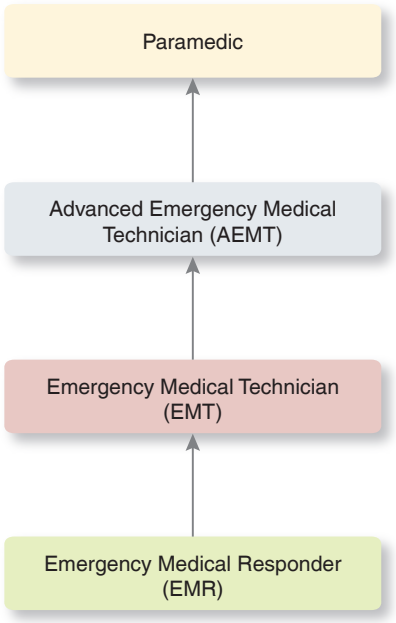
A variety of types of EMS providers exist across the United States in urban, suburban, and rural areas and in industrial settings. They can be quite different in their organization and each has its own set of advantages and disadvantages. The various types of EMS services are:

- **Fire Department EMS.** Fire-based EMS services use the response structure that is already in place for fire suppression. Fire-based EMS is prevalent across the country and is found in paid, part-paid, and volunteer departments that serve a wide variety of populations in rural, suburban, and urban areas. Fire-based EMS can offer either a transport or nontransport service. Fire-based EMS services often provide only emergency responses for 911 calls.
- **Municipal EMS.** Municipal EMS services are often referred to as third services, implying that the first two public safety services are the fire department and the police department with EMS being the third public safety service. Although Municipal EMS works closely with the fire department and police department, the public safety director, public health director, or some other municipal government official may control it. Municipal EMS services often provide only emergency responses for 911 calls. However, some municipal services also provide inter-facility transfers and other nonemergency transports.
- **Private EMS.** There is a long history in the United States of EMS being provided by private companies. Municipalities may set rules within which the private EMS company must operate; however, the municipality does not govern or control the EMS service. Private EMS services often provide 911 emergency responses, inter-facility transfers, and other nonemergency transport services.
- **Hospital-Based EMS.** A for-profit or a not-for-profit hospital organization controls a hospital-based EMS service. These EMS services operate similarly to private EMS services and often provide 911 emergency responses, inter-facility transfers, and other nonemergency transport services.
- **Law Enforcement EMS.** Like the fire service, law enforcement agencies already have many of the requirements for responding to medical emergencies in place. Law enforcement EMS is quite rare; however, it may be found in smaller communities where the demand for law enforcement is less burdensome.
- **Public Safety Officer.** Some communities have cross-trained personnel who respond to fire, police, and EMS emergencies and have combined all of the services into one. These individuals are often referred to as public safety officers.

Levels of Training

The *National EMS Scope of Practice Model*—released by the NHTSA in 2006—was developed to bring a higher degree of consistency to EMS throughout the United States, improve patient care and safety, allow for easier reciprocity between states, and decrease public confusion by identifying specific national levels of EMS practitioners. The *National Scope of Practice Model* identifies the following four levels of EMS practitioners (Figure 1-2 ■):

- **Emergency Medical Responder (EMR)** provides immediate lifesaving care to patients who have accessed the EMS system while they are waiting for higher level responders (EMTs and/or paramedics) to arrive on the scene. The EMR uses basic airway, ventilation, and oxygen therapy devices; takes patient vital signs; and provides stabilization of the spine and suspected extremity injuries, eye irrigation, bleeding control, emergency moves, CPR, automated external defibrillation, and emergency childbirth care.
- **Emergency Medical Technician (EMT)** provides basic emergency medical care and transportation to patients who access the EMS system. The interventions



■ **FIGURE 1-2** The four levels of EMS practitioners.

provided by the EMT include those performed by the EMR but with basic equipment found on an ambulance. The EMT level is similar in scope to the EMR level with the addition of advanced oxygen therapy and ventilation equipment, pulse oximetry, use of automatic blood pressure monitoring equipment, and limited medication administration.

- **Advanced Emergency Medical Technician (AEMT)** provides both basic and limited advanced emergency medical care and transportation to patients in the prehospital environment. The AEMT performs the same skills as the EMT, with the addition of the use of advanced airway devices, monitoring of blood glucose levels, initiation of intravenous and intraosseous (in the bone marrow) infusions, and administration of a select number of medications.
- **Paramedic** scope of practice includes the skills performed by the EMT and AEMT with the addition of more advanced assessment and patient management skills and provision of the highest level of prehospital care. Paramedics perform advanced assessments, form a field impression, and provide invasive and drug interventions as well as transport. Their care is designed to reduce disability and death of patients who access the EMS system.

The Health Care System

EMTs and other EMS personnel are an integral part of a community's health care system—a network of medical care that begins in the field and extends to hospitals and other treatment centers. In essence, EMTs provide **prehospital care**—emergency medical treatment given to patients before they are transported to a hospital or other facility. (In some areas, the term *out-of-hospital care* is preferred, reflecting a trend toward providing care on the scene with or without subsequent transport to a hospital. Out-of-hospital care also includes care provided during interfacility transport. Your instructor can provide information on how or if this term may apply to your EMS system.)

The EMT may be required to decide on the facility to which the patient must be transported. The most familiar destination is the hospital emergency department, which is staffed by physicians, nurses, and others trained in emergency medical treatment. Here patients are stabilized and prepared for further care. Some patients may need to be transported to special facilities such as the following:

- **Trauma center** for rapid surgical intervention and specialized treatment of injuries that generally exceed hospital emergency department capabilities (Figure 1-3 ■)
- **Burn center** for specialized treatment of serious burns, often including long-term care and rehabilitation
- **Obstetrical center** for high-risk obstetric patients
- **Pediatric center** for specialized treatment of infants and children
- **Poison center** for specialized treatment of poisoning victims
- **Stroke center** to provide specialized care for specific acute stroke patients
- **Cardiac center** for the rapid and advanced management of patients suffering cardiac emergencies
- **Hyperbaric center** for the treatment of certain toxic exposures, diving emergencies, and other conditions
- **Spine injury center** for the management of patients with severe spine injuries
- **Psychiatric center** to care for patients with behavioral emergencies

You will often get called to emergencies where you and your partner are the only trained emergency

■ **FIGURE 1-3** A trauma center can provide rapid surgical intervention and treatment of injuries that generally exceed hospital emergency department capabilities. (© Edward T. Dickinson, MD)

■ **FIGURE 1-4** The EMT works closely with other public safety personnel.

■ **FIGURE 1-5** You will often work as a team with paramedics and others.

personnel involved. At other times, two or more emergency services are needed at the scene (Figure 1-4 ■). Specialized rescue teams and fire personnel, as well as law enforcement, may be involved. As a member of the team that stabilizes and transports a patient (Figure 1-5 ■), you will be in a position to serve as the liaison between the community's medical services and those public safety workers.

THE EMT

In this section we will discuss the roles and responsibilities as well as the desired professional attributes of the EMT.

Roles and Responsibilities

Although specific responsibilities may vary from one area to another, your general responsibilities as an EMT include personal safety and the safety of others, patient assessment and emergency medical care, safe lifting and moving, patient transport and transfer, record keeping and data collection, and patient advocacy. These and other responsibilities are found in Table 1-1. All of these are covered in greater detail in later chapters.

TABLE 1-1 Roles and Responsibilities of the Emergency Medical Technician

- Maintain vehicle and equipment readiness.
- Ensure safety of the EMS crew, the patient, and bystanders at the scene.
- Operate the emergency vehicle.
- Assess the patient.
- Provide emergency care.
- Safely lift and move the patient.
- Prepare oral and written reports.
- Safely transport the patient.
- Transfer patient care.
- Perform record keeping and data collection.
- Serve as the patient's advocate.
- Provide emotional support to the patient, relatives, and others at the scene.
- Integrate the EMS service with other emergency and nonemergency services.
- Resolve the emergency incident.
- Maintain medical and legal standards.
- Provide administrative support.
- Enhance professional development.
- Develop and maintain community relations.

In light of these roles and responsibilities, the **Americans with Disabilities Act (ADA)** of 1990 protects individuals who have a documented disability from being denied initial or continued employment based on their disability. The employer must make necessary and reasonable adjustments so that individuals with disabilities are not precluded from employment. Check with your state EMS office and ADA representative to seek additional information.

Personal Safety and the Safety of Others

Your first and most important priority is to protect your own safety (Figure 1-6 ■). Remember this rule: You cannot help the patient, other rescuers, or yourself if you

■ **FIGURE 1-6** The EMT must ensure personal safety at all times. (© Ed Effron)

are injured. You also do not want to endanger other rescuers by forcing them to rescue you—instead of the patient. Once scene safety is ensured, the patient's needs become your priority.

Always drive safely using proper precautions to avoid traffic accidents. Use a seat belt whenever you drive or ride, unless you need to remove it to care for the patient. Remove yourself from potentially hazardous sites such as high-traffic areas, downed power lines, gasoline leaks, fires, chemical spills, radiation leaks, and so on. Never enter a volatile crowd situation, such as a riot, crime scene, or hostage situation, until it has been controlled by law enforcement. Take extra precautions when you suspect that a patient, relative, or bystander at the scene is under the influence of drugs or alcohol, has a behavioral disorder, or is emotionally charged, because these individuals have a tendency to suddenly change their behavior and may become a danger to you and your crew.

At the scene, follow directions from police, fire, utility, and other expert personnel. Create a safe area in which the patient can be treated (away from the threat of fire or explosion, for example). Redirect traffic for the safety of patients and bystanders.

Wear reflective emblems or clothing at night, and provide adequate lighting at an accident scene. Minimize personal injury from jagged metal or broken glass at an accident scene by wearing a helmet or hard hat, protective outerwear, eye protection, and leather gloves. In addition, wear protective gear (such as gloves, eye protection, mask, and gown) as necessary to avoid infectious diseases.

Patient Assessment and Emergency Care

After you have ensured scene safety, you must gain access to patients, recognize and evaluate problems, and provide emergency care (Figure 1-7 ■)—often in situations that involve more than one patient. First, always perform a primary assessment to help you identify and care for immediately life-threatening problems, such as airway compromise, respiratory insufficiency, cardiac arrest, or severe bleeding. Then, complete a secondary assessment, after which you can stabilize and treat other emergency injuries or conditions you discover or suspect. Work as quickly as possible while avoiding undue haste, carelessness, and mishandling of the patient. Always be aware of changing conditions and ensure that the scene remains safe.

Safe Lifting and Moving

Prevent further injury of patients by always using the easiest and safest recommended emergency urgent or nonurgent moves and equipment. Use proper body mechanics and make sure you have sufficient help to lift and move patients and equipment to avoid injuring yourself.

Transport and Transfer of Care

Before leaving the scene, determine which facility (local emergency department, pediatric hospital, burn center, or other) is most appropriate. Consider the patient's condition, the extent of injuries, prior health care contact, the relative locations, hospital staffing, and destination protocols when making transport decisions. Consult medical direction if necessary and follow your local transport protocols.

Use the communications equipment available to you to notify the receiving facility of the number of patients, the destination(s), and the nature and extent of injuries. Alert the emergency department or receiving facility about high-priority patients and what will be needed immediately upon arrival, such as a trauma team or a stroke team. Report changes in the patient's condition, and consult medical direction during transport as appropriate and as required (Figures 1-8 ■ and 1-9 ■).

Drive to minimize further injury and maximize patient comfort. Obey appropriate laws and regulations,

■ **FIGURE 1-7** The EMT is responsible for providing competent patient care.

■ **FIGURE 1-8** The EMT can get on-line medical direction by telephone, cell phone, or radio.

■ **FIGURE 1-9** Assessment and emergency care are continued en route to the medical facility.

■ **FIGURE 1-11** As soon as possible, complete the written or electronic prehospital care report.

and use lights and sirens properly. Realize that not all patients require the use of lights and sirens. Using emergency response and transport only when necessary protects you and other EMS personnel, the patient and the public. When you reach the destination, help remove the wheeled stretcher and maneuver it into the emergency department.

Report both verbally and in writing to the appropriate receiving facility personnel what injuries or conditions were identified, what care has been given to the patient, and the patient's response to treatment. Provide other assistance as needed and do not leave before the patient has been properly transferred to the care of the receiving facility personnel (Figure 1-10 ■).

Record Keeping and Data Collection

Throughout your shift, maintain an up-to-date log of calls, if required. Before leaving the hospital, or as soon as possible, complete the written or electronic prehospital care report (Figure 1-11 ■). A copy of this report will become part of the patient's medical record and part of your EMS system's permanent records.

■ **FIGURE 1-10** The EMT is responsible for properly transferring the care of the patient to the appropriate medical personnel.

Patient Advocacy

As an emergency care provider, you are also responsible for protecting the patient's rights. At the scene, collect and safeguard a patient's valuables on his person, transport them with the patient, and document what was given to the emergency department personnel. In the field, protect the patient's privacy, shield the patient as much as possible from curious bystanders, and answer questions truthfully. Conceal the body of a patient who has died from curious onlookers.

Make sure that the patient's friends or loved ones at the scene know how to get to the hospital or medical facility that you are transporting the patient to. In some systems, a relative may be transported in the operator's section of the ambulance. At the receiving facility, act as the patient's advocate by ensuring you have provided necessary information, especially about circumstances hospital personnel have not witnessed. Honor any patient requests that you reasonably can, such as notifying a relative or ensuring that the patient's home is secure. Be sure to adhere to all confidentiality rules when doing such activities.

Professional Attributes

A number of professional attributes are important to maximize your effectiveness as an EMT. They include appearance, knowledge, skills, the ability to meet physical demands, general interests and temperament, and maintenance of certification and licensure. See Table 1-2 for the characteristics of professional behavior for EMTs.

Appearance

Excellent personal grooming and a neat, clean appearance help instill confidence in patients treated by EMTs—and help protect them from contamination that could be caused by dirty hands, dirty fingernails, or soiled clothing. Respond to the scene in complete uniform

TABLE 1-2 Characteristics of Professional Behavior for EMTs

- Integrity
- Empathy
- Self-motivation
- Professional appearance and hygiene
- Self-confidence
- Effective time management
- Good verbal and written communication skills
- Teamwork and diplomacy
- Respect for patients, coworkers, and other health care professionals
- Patient advocate
- Careful delivery of service

or appropriate dress to portray the positive image you want to communicate. Remember, you are on a medical team. Your appearance should send the message that you are competent and can be trusted to make the right decisions.

Knowledge and Skills

To practice as an EMT, you need to successfully complete the basic training program for EMTs as outlined by the U.S. Department of Transportation. In addition to the required course work, you also need to know the following:

- **How to use and maintain common emergency equipment** such as suction machines, oxygen-delivery systems, airway adjuncts, automated external defibrillators, spinal immobilization equipment, splints, obstetrical kits, various types of patient-moving devices, and tools to gain access to the patient
- **How to assist with the administration of medications** approved by medical direction.
- **How to clean, disinfect, and sterilize equipment that is not disposable**.
- **The safety and security measures** for you, your partner, other rescuers, and for the patient and bystanders.
- **The territory and terrain** within the service area to allow expedient response to the scene and to the appropriate receiving facility.
- **State and local traffic laws and ordinances** concerning emergency transportation of the sick and injured. Ambulances are given certain privileges, but they are not immune from all traffic laws.

Use opportunities for continuing education to expand your knowledge and learn about advances in patient care, new equipment, or better ways of using existing equipment. Take refresher courses to renew your knowledge and skills. Finally, maintain up-to-date knowledge of local, state, and federal legislation, regulations, standards, guidelines, and issues that affect the emergency medical systems in your area.

Physical Demands

To be an EMT, you must be in good physical health. You must be able to lift and carry up to 125 pounds. Your eyesight must be good (correction by lenses is permitted), and you must have good color vision to properly assess a patient and drive safely. Color vision is necessary to determine various changes in the color of the skin, nail beds, lips, and inside the mouth, which provide critical information about the severity and the possible condition the patient is experiencing. You must also communicate effectively both orally and in writing. This is necessary when communicating with patients, crew members, other emergency response personnel, and the medical staff. Your hearing must be good enough to accurately hear radio communications, patient and bystander responses, auscultated blood pressure, auscultated and other abnormal patient noises, communication from other crew members at the scene, and oral instructions.

Personal Traits

In times of crisis, patients look for someone to reestablish order in a suddenly chaotic world. Chances are that the person the patient looks to will be you. The patient's trust in you can bring out the best in you, but it can also cause you a great deal of stress. To be effective as an EMT, you should have the following characteristics:

- **A calm and reassuring personality.** As an EMT, you will often be required to perform skills and procedures while speaking in a reassuring and calming voice to a patient who may be agitated, in shock, or in a great deal of pain.
- **Leadership ability.** You must be able to assess a situation quickly, step forward to take control when appropriate, set action priorities, give clear and concise directions, be confident and persuasive enough to be obeyed, and carry through with what needs to be done.
- **Good judgment.** You must be able to make appropriate decisions quickly, often in unsafe or stressful situations involving human beings in crisis.
- **Good moral character.** Although there are many legal constraints on the profession, you also have ethical obligations. You are in a position of public trust that can never be wholly defined by statute or case law alone.
- **Stability and adaptability.** Being an EMT can be stressful. Exhaustion, frustration, anger, and grief are part of the package. You must learn how to delay expressing your feelings until the emergency is over. You must also understand that intense, emotional reactions are normal and seeking support from coworkers, counselors, friends, and family is an important aspect of keeping yourself mentally and physically fit.

- **Ability to listen.** You must be an effective listener when gathering information from patients and bystanders and when receiving orders from medical direction or others at the scene. You should exhibit empathy and compassion in your responses; however, you must always maintain a high degree of professionalism, confidence, and competence.
- **Resourcefulness and ability to improvise.** In some situation, a piece of equipment, a tool, or a technique won't quite work. You need to be resourceful, quick thinking, and adaptable to make things work for the best emergency care for your patient. You may need to improvise to care for and move some patients. As an example, if a patient entrapped in an overturned vehicle needs immediate ventilation, you must determine the most effective method to gain entry to the vehicle to provide ventilation with both you and the patient in an awkward and unusual position. You must also continue to deliver ventilation while removing the patient from the wrecked vehicle. Each call, situation, and patient is different and requires quick thinking and resourcefulness to provide efficient and effective emergency care.
- **Cooperativeness.** Often your call will involve other emergency services, such as the fire service and the police. You must be able to act as a leader while fully cooperating with others at the scene to provide the best possible emergency care to the patient.

Maintenance of Certification and Licensure

It is the personal responsibility of each EMT to maintain certification and licensure to practice. This involves meeting the necessary continuing education requirements, verifying skill competency, avoiding any criminal or unethical behavior, and submitting all fees necessary to maintain current certification and licensure.

EMS SYSTEM ORGANIZATION AND STANDARDS

In this section we will discuss EMS organization and standards as overseen by state EMS agencies and by medical oversight of EMS with particular emphasis on quality improvement (QI) and patient safety.

State EMS Agency Role

According to the National Association of State EMS Officials (NASEMSO), every state and territory in the United States has a lead EMS agency. The primary responsibilities of the state EMS agency are:

- Overall planning of the statewide EMS system
- Coordination of the statewide EMS system
- Regulation of the statewide EMS system
- Licensing local EMS agencies and personnel

As EMS continues to evolve, overlap between the EMS, public safety, and public health often occurs. The state EMS agency is actively involved in ensuring that a high-quality EMS is provided to protect the health and safety of the public.

Medical Oversight of EMS

Medical oversight is a comprehensive term for the responsibilities of the EMS system's medical director. Responsibilities include the clinical and administrative functions and activities performed by the medical director as necessary to exercise ultimate responsibility for the emergency care provided by individual personnel and the entire EMS system. (The medical director's role is defined more fully in the next section.)

Medical oversight includes both indirect medical oversight and direct medical oversight. **Indirect medical oversight** makes up the majority of the medical director's responsibilities and activities. These are the processes and activities that influence and control the practice of prehospital care in the EMS system. The responsibilities and activities of indirect medical oversight are, in general, the routine duties and responsibilities associated with the daily operations of the EMS system.

Direct medical oversight is real-time oversight or medical direction provided by a physician to an EMS provider who is seeking immediate feedback or direction that impacts the patient's care. Direct medical oversight is either on-line or on-scene. **On-line medical direction** takes place when the EMS provider and physician communicate by cell phone, telephone, radio, or video technology with the physician providing immediate feedback and medical direction to the EMS personnel regarding the patient's diagnosis, condition, and emergency care. **On-scene medical direction** is feedback and medical direction regarding the patient's diagnosis, condition, and emergency care provided by an EMS medical director physician who is on-scene with the EMS crew.

The Medical Director, Protocols, and Standing Orders

As an EMT, you are the designated agent of the physician **medical director** of your EMS system. The emergency care you render to patients is considered an extension of the medical director's authority. (Learn your own state laws, statutes, and regulations regarding medical direction.)

As described under "Medical Oversight of EMS," the medical director is a physician who is legally responsible for the clinical and patient care aspects of the EMS system. An EMS medical director is responsible for providing **medical direction** and is also involved in overseeing and providing EMS education programs, refresher courses, and continuing education; credentialing

providers for the system; and facilitating the quality improvement system. Every EMS must have a medical director to provide any level of prehospital care.

A primary charge of medical direction is developing and establishing the guidelines under which the EMS personnel function. These guidelines are referred to as **protocols**. Protocols comprise a full set of guidelines that define the entire scope of medical care (triage, treatment, transport, destination). Often referred to as orders, protocols may consist of clinical care guidelines that can be provided by both off-line and on-line medical direction.

Off-line medical direction, which is a function of indirect medical oversight, is provided through a set of predetermined, written guidelines, often referred to as standing orders, that allow EMTs to use their judgment to administer emergency medical care according to the written guidelines without having to contact a physician. As an example, the protocol for chest pain may read: (1) Administer oxygen via nonrebreather mask at 15 lpm; (2) place patient in position of comfort; (3) administer one patient-prescribed nitroglycerin tablet if systolic blood pressure is greater than 90 mmHg; (4) administer one 160–325 mg aspirin; (5) contact advanced life support; (6) if the patient does not experience relief of chest pain from one nitroglycerin tablet, contact medical direction to consider administering additional doses.

Items 1 through 5 are all provided under off-line medical direction or standing orders. The EMT is expected to perform these treatments and activities for a patient having chest pain without having to contact the physician prior to treatment. However, as noted in item 6, if the patient is continuing to experience chest pain, the EMT must contact medical direction and receive permission to administer any additional doses of nitroglycerin. Because item 6 requires direct communication with the physician, it is considered on-line medical direction.

Standing orders are a subset of protocols that do not require real-time physician input. In some systems, the term is synonymous with off-line medical direction. In some systems, the term *standing order* refers specifically to treatments that can be performed if communication cannot be established or is lost with medical direction.

Quality Improvement

Quality improvement (QI), also known as *continuous quality improvement (CQI),* is a system of internal and external reviews and audits of all aspects of an emergency medical system. To ensure the public receives the highest quality of prehospital care, the goals of QI are to identify those aspects of the system that can be improved and to implement plans and programs that will remedy any shortcomings. It is important to recognize that QI is not designed to evaluate individual performance, but rather is intended to determine how effective the system is and to identify what improvements can be made to deliver a better service. In summary, QI generally should not be used to penalize anyone but as an evaluation system geared toward overall system improvement.

As an EMT, your role in QI (Figure 1-12 ■) is to:

- **Document carefully.** Carefully and thoroughly document each call. Prehospital care reports that you prepare are studied by QI committees to spot things such as excessive response times, which might be

■ **FIGURE 1-12** The EMT takes an active role in quality improvement.

remedied by redeploying ambulances, or to identify seldom-used skills for refresher training.
- **Perform reviews and audits.** Become involved in the QI process by volunteering for QI committee work or by critiquing the performance of other EMTs at the scene of a call.
- **Obtain feedback.** Gather feedback from patients, other EMS personnel, and hospital staff. This may be done formally through surveys distributed to patients and hospital staff members or informally by seeking advice about your performance after a call from physicians, nurses, or other medical personnel.
- **Maintain equipment.** Conduct preventative maintenance on equipment and ensure it is in proper working order.
- **Participate in continuing education.** Participate in refresher courses and continuing education to reinforce, update, and expand your knowledge and skills.
- **Maintain skills.** It is important to continuously practice your skills to a level of mastery.

Patient Safety

One of the most important issues that must be addressed when dealing with patients in the prehospital environment is safe delivery of care. Some activities, however, are considered "high risk" and put the patient at greater risk for medical mistakes, injury, or exacerbation of an existing injury. Some of these high-risk activities include:

- Transfer of care or "hand-off" at the scene between emergency responders or between medical personnel at the medical facility
- Poor communication that leads to misunderstandings and medical errors
- Carrying and moving patients in a manner that puts them at risk for being dropped
- Involvement in an ambulance crash while transporting the patient to a medical facility
- Lack of spinal immobilization or improper spinal immobilization procedures that increase the risk of converting a stable spinal column injury into an unstable spinal column injury, or improper immobilization that exacerbates an existing injury

Errors during patient care also put patients at risk. These errors usually result from failure of the EMT to properly perform a skill, failure of the EMT to follow the rules, or failure of the EMT to obtain or retain the appropriate knowledge to perform patient care effectively.

You can follow these guidelines to prevent errors that may jeopardize the patient's safety:

- Develop clear protocols.
- Light the scene effectively.
- Minimize interruptions during assessment and emergency care.
- Clearly mark all drugs and packages so each is distinct.
- Reflect on all actions.
- Question all assumptions.
- Use decision aids if necessary.
- Ask for assistance if you need it.

EMS RESEARCH

The traditional approach to the practice of medicine involved a combination of a strong foundation of scientific knowledge, intuition, and good judgment. As the medical practice has evolved, the science component has become more emphasized through the concept of **evidence-based medicine**. Evidence-based medicine focuses on research to provide clear evidence that certain procedures, medications, and equipment improve the patient's outcome. The following four steps are common in evidence-based decision making:

Evidence-Based Decision-Making Steps

1. Formulate a question about emergency care that needs to be answered based on your clinical practice.
2. Search medical literature for research data that are related and applicable to the question.
3. Appraise the evidence for validity and reliability.
4. If the evidence supports a change in practice, change protocols and implement the change in prehospital emergency care.

Also see the discussion of evidence-based guidelines (EBG) in the next section.

In 2001, the *National EMS Research Agenda*, which was commissioned by the NHTSA and the Maternal Child Health Bureau, was published. The intent of the document was to seek support to elevate the science of EMS and prehospital care to the next level. By doing so, research provides the data to assist EMS professionals in providing the best care possible through innovative methods of delivery. The federal agencies that were already involved in EMS research and enlisted to continue to help were:

- NHTSA
- Agency for Healthcare Research and Quality (AHRQ)
- Centers for Disease Control (CDC)
- Health Research and Services Administration (HRSA)
- National Fire Academy
- Department of Defense
- National Institutes of Health (NIH)

Since the publication of the *National EMS Research Agenda* in 2001, progress has been made with efforts to conduct and coordinate EMS research. Some recent initiatives and resources that promote EMS research are:

- In 2014, the Federal Interagency Committee on EMS (FICEMS) adopted and published a strategic goal to include "data-driven and evidence-based EMS systems that promote patient care quality."