

**National Heart, Lung,  
and Blood Institute**

**National Asthma Education  
and Prevention Program**

**Expert Panel Report 3:  
Guidelines for the Diagnosis and  
Management of Asthma**

**Full Report 2007**



**U.S. Department of Health and Human Services**  
National Institutes of Health  
National Heart, Lung, and Blood Institute

## CONTENTS

Acknowledgements and Financial Disclosures .....	xi
Acronyms and Abbreviations .....	xix
Preface .....	xxii
<b>Section 1, Introduction .....</b>	<b>1</b>
<b>Overall Methods Used To Develop This Report.....</b>	<b>2</b>
Background .....	2
Systematic Evidence Review Overview.....	3
Inclusion/Exclusion Criteria.....	3
Search Strategies .....	3
Literature Review Process .....	3
Preparation of Evidence Tables.....	6
Ranking the Evidence.....	7
Panel Discussion .....	8
Report Preparation .....	8
References.....	9
 <b>Section 2, Definition, Pathophysiology and Pathogenesis of Asthma, and Natural History of Asthma .....</b>	<b>11</b>
Key Points: Definition, Pathophysiology and Pathogenesis of Asthma, and Natural History of Asthma .....	11
Key Differences From 1997 and 2002 Expert Panel Reports .....	12
Introduction .....	12
Definition of Asthma .....	12
Pathophysiology and Pathogenesis of Asthma.....	14
Pathophysiologic Mechanisms in the Development of Airway Inflammation .....	16
Inflammatory Cells .....	16
Inflammatory Mediators .....	18
Immunoglobulin E .....	19
Implications of Inflammation for Therapy .....	19
Pathogenesis .....	20
Host Factors .....	20
Environmental Factors.....	22
Natural History of Asthma .....	23
Natural History of Persistent Asthma .....	24
Children.....	24
Adults .....	25
Summary .....	27
Effect of Interventions on Natural History of Asthma.....	27
<b>Implications of Current Information About Pathophysiology and Pathogenesis, and Natural History for Asthma Management.....</b>	<b>28</b>
References.....	28

<b>Section 3, The Four Components of Asthma Management .....</b>	<b>35</b>
Introduction .....	35
<b>Section 3, Component 1: Measures of Asthma Assessment and Monitoring.....</b>	<b>36</b>
Introduction .....	36
Overview of Assessing and Monitoring Asthma Severity, Control, and Responsiveness in Managing Asthma.....	36
Key Points: Overview of Measures of Asthma Assessment and Monitoring .....	36
Key Differences From 1997 and 2002 Expert Panel Reports .....	37
Diagnosis of Asthma .....	40
Key Points: Diagnosis of Asthma .....	40
Key Differences From 1997 and 2002 Expert Panel Reports .....	41
Medical History .....	41
Physical Examination .....	42
Pulmonary Function Testing (Spirometry).....	43
Differential Diagnosis of Asthma .....	45
Initial Assessment: Characterization of Asthma and Classification of Asthma Severity.....	47
Key Points: Initial Assessment of Asthma .....	47
Key Differences From 1997 and 2002 Expert Panel Reports .....	48
Identify Precipitating Factors .....	48
Identify Comorbid Conditions That May Aggravate Asthma .....	49
Assess the Patient's Knowledge and Skills for Self-Management.....	49
Classify Asthma Severity .....	49
Assessment of Impairment .....	50
Assessment of Risk .....	51
Periodic Assessment and Monitoring of Asthma Control Essential for Asthma Management.....	52
Key Points: Periodic Assessment of Asthma Control.....	52
Key Differences From 1997 and 2002 Expert Panel Reports .....	54
Goals of Therapy: Asthma Control.....	55
Asthma Control.....	55
Measures for Periodic Assessment and Monitoring of Asthma Control .....	56
Monitoring Signs and Symptoms of Asthma .....	57
Monitoring Pulmonary Function .....	58
Spirometry .....	58
Peak Flow Monitoring .....	59
Peak Flow Versus Symptom-Based Monitoring Action Plan .....	60
Monitoring Quality of Life .....	61
Monitoring History of Asthma Exacerbations .....	63
Monitoring Pharmacotherapy for Adherence and Potential Side Effects .....	63
Monitoring Patient–Provider Communication and Patient Satisfaction .....	63
Monitoring Asthma Control With Minimally Invasive Markers and Pharmacogenetics .....	64
Pharmacogenetics in Managing Asthma.....	66
Methods for Periodic Assessment and Monitoring of Asthma Control .....	66
Clinician Assessment .....	67
Patient Self-Assessment.....	67
Population-Based Assessment .....	67
Referral to an Asthma Specialist for Consultation or Comanagement .....	68
References .....	82

<b>Section 3, Component 2: Education for a Partnership in Asthma Care .....</b>	<b>93</b>
Key Points: Education for a Partnership in Asthma Care.....	93
Key Points: Provider Education .....	95
Key Differences From 1997 and 2002 Expert Panel Reports .....	95
Introduction .....	96
Asthma Self-Management Education at Multiple Points of Care.....	97
Clinic/Office-Based Education .....	97
Adults—Teach Asthma Self-Management Skills To Promote Asthma Control .....	97
Written Asthma Action Plans, Clinician Review, and Self-Monitoring .....	98
Patient–Provider Partnership .....	99
Health Professionals Who Teach Self-Management.....	100
Education With Multiple Sessions .....	101
Children—Teach Asthma Self-Management Skills To Promote Asthma Control.....	101
Emergency Department/Hospital-Based Education .....	102
Adults .....	102
Emergency Department Asthma Education .....	103
Hospital-Based Asthma Education.....	104
Children.....	105
Educational Interventions by Pharmacists .....	106
Educational Interventions in School Settings .....	107
Community-Based Interventions.....	108
Asthma Education .....	108
Home-Based Interventions .....	109
Home-Based Asthma Education for Caregivers.....	109
Home-Based Allergen-Control Interventions.....	109
Other Opportunities for Asthma Education .....	111
Education for Children Using Computer-Based Technology .....	111
Education on Tobacco Avoidance for Women Who Are Pregnant and Members of Households With Infants and Young Children.....	112
Case Management for High-Risk Patients .....	113
Cost-Effectiveness .....	114
Tools for Asthma Self-Management .....	115
Role of Written Asthma Action Plans for Patients Who Have Asthma.....	115
Role of Peak Flow Monitoring.....	120
Goals of Asthma Self-Management Education and Key Educational Messages .....	121
Establish and Maintain a Partnership .....	124
Teach Asthma Self-Management .....	125
Jointly Develop Treatment Goals.....	131
Assess and Encourage Adherence to Recommended Therapy .....	131
Tailor Education to the Needs of the Individual Patient.....	133
Knowledge and Beliefs .....	133
Health Literacy .....	134
Cultural/Ethnic Considerations.....	135
Maintain the Partnership.....	135
Asthma Education Resources .....	140
Provider Education .....	141
Methods of Improving Clinician Behaviors .....	141
Implementing Guidelines—Recommended Practices .....	141
Communication Techniques .....	143
Methods of Improving System Supports .....	144
Clinical Pathways .....	144
Clinical Decision Supports .....	145
References.....	146

<b>Section 3, Component 3: Control of Environmental Factors and Comorbid Conditions That Affect Asthma.....</b>	<b>165</b>
Key Points: Control of Environmental Factors and Comorbid Conditions That Affect Asthma.....	165
Key Differences From 1997 Expert Panel Report.....	166
Introduction .....	167
Inhalant Allergens .....	167
Diagnosis—Determine Relevant Inhalant Sensitivity .....	167
Management—Reduce Exposure.....	169
Immunotherapy .....	172
Assessment of Devices That May Modify Indoor Air.....	174
Occupational Exposures .....	175
Irritants.....	175
Environmental Tobacco Smoke.....	175
Indoor/Outdoor Air Pollution and Irritants.....	176
Formaldehyde and Volatile Organic Compounds.....	176
Gas Stoves and Appliances.....	176
Comorbid Conditions.....	177
Allergic Bronchopulmonary Aspergillosis .....	177
Gastroesophageal Reflux Disease .....	178
Obesity .....	179
Obstructive Sleep Apnea.....	179
Rhinitis/Sinusitis .....	180
Stress, Depression, and Psychosocial Factors in Asthma .....	180
Other Factors .....	181
Medication Sensitivities .....	181
Aspirin .....	181
Beta-Blockers .....	182
Sulfite Sensitivity .....	182
Infections .....	182
Viral Respiratory Infections .....	182
Bacterial Infections .....	183
Influenza Infection .....	183
Female Hormones and Asthma .....	183
Diet.....	184
Primary Prevention of Allergic Sensitization and Asthma .....	184
References.....	190
<b>Section 3, Component 4: Medications.....</b>	<b>213</b>
Key Points: Medications .....	213
Key Differences From 1997 and 2002 Expert Panel Reports .....	215
Introduction .....	215
Overview of the Medications .....	216
Long-Term Control Medications .....	216
Inhaled Corticosteroids .....	216
Mechanism .....	216
Inhaled Corticosteroid Insensitivity.....	217
Efficacy of Inhaled Corticosteroids as Compared to Other Long-Term Control Medications as Monotherapy .....	217
Efficacy of Inhaled Corticosteroid and Adjunctive Therapy (Combination Therapy).....	217
Dose-Response and Delivery Device .....	218
Variability in Response and Adjustable Dose Therapy .....	219
Safety of Inhaled Corticosteroids .....	220

Key Points: Safety of Inhaled Corticosteroids .....	220
Key Points: Inhaled Corticosteroids and Linear Growth in Children .....	222
Oral Systemic Corticosteroids .....	224
Cromolyn Sodium and Nedocromil .....	224
Immunomodulators .....	225
Omalizumab .....	225
Antibiotics .....	226
Others .....	226
Leukotriene Modifiers .....	227
Inhaled Long-Acting Beta <sub>2</sub> -Agonists .....	229
Safety of Long-Acting Beta <sub>2</sub> -Agonists .....	231
Key Points: Safety of Inhaled Long-Acting Beta <sub>2</sub> -Agonists .....	231
Methylxanthines .....	234
Tiotropium Bromide .....	235
Quick-Relief Medications .....	235
Anticholinergics .....	235
Inhaled Short-Acting Beta <sub>2</sub> -Agonists .....	235
Safety of Inhaled Short-Acting Beta <sub>2</sub> -Agonists .....	236
Key Points: Safety of Inhaled Short-Acting Beta <sub>2</sub> -Agonists .....	236
Systemic Corticosteroids .....	237
Route of Administration .....	238
Alternatives to CFC-Propelled MDIs .....	238
Spacers and Valved Holding Chambers .....	239
Complementary and Alternative Medicine .....	240
Key Points: Complementary and Alternative Medicine .....	240
Acupuncture .....	240
Chiropractic Therapy .....	241
Homeopathy and Herbal Medicine .....	241
Breathing Techniques .....	241
Relaxation Techniques .....	242
Yoga .....	242
References .....	252
<b>Section 4, Managing Asthma Long Term: Overview .....</b>	<b>277</b>
Key Points: Managing Asthma Long Term .....	277
Key Differences From 1997 and 2002 Expert Panel Reports .....	278
Introduction .....	279
<b>Section 4, Managing Asthma Long Term in Children 0–4 Years of Age and 5–11 Years of Age .....</b>	<b>281</b>
Diagnosis and Prognosis of Asthma in Children .....	281
Diagnosis of Asthma .....	281
Prognosis of Asthma .....	281
Prevention of Asthma Progression .....	282
Monitoring Asthma Progression .....	283
Treatment: Principles of Stepwise Therapy in Children .....	284
Achieving Control of Asthma .....	285
Selecting Initial Therapy .....	285
Adjusting Therapy .....	286
Maintaining Control of Asthma .....	288
Key Points: Inhaled Corticosteroids in Children .....	289
Key Points: Managing Asthma in Children 0–4 Years of Age .....	289

Treatment: Pharmacologic Issues for Children 0–4 Years of Age.....	290
FDA Approval.....	291
Delivery Devices.....	291
Treatment: Pharmacologic Steps for Children 0–4 Years of Age.....	291
Intermittent Asthma .....	292
Step 1 Care, Children 0–4 Years of Age.....	292
Persistent Asthma .....	293
Step 2 Care, Children 0–4 Years of Age.....	293
Step 3 Care, Children 0–4 Years of Age.....	294
Step 4 Care, Children 0–4 Years of Age.....	295
Step 5 Care, Children 0–4 Years of Age.....	296
Step 6 Care, Children 0–4 Years of Age.....	296
Key Points: Managing Asthma in Children 5–11 Years of Age.....	296
Treatment: Special Issues for Children 5–11 Years of Age .....	297
Pharmacologic Issues .....	297
School Issues .....	298
Sports and Exercise Issues .....	298
Treatment: Pharmacologic Steps for Children 5–11 Years of Age .....	299
Intermittent Asthma .....	299
Step 1 Care, Children 5–11 Years of Age.....	299
Persistent Asthma .....	300
Step 2 Care, Children 5–11 Years of Age.....	300
Step 3 Care, Children 5–11 Years of Age.....	301
Step 4 Care, Children 5–11 Years of Age.....	303
Step 5 Care, Children 5–11 Years of Age.....	303
Step 6 Care, Children 5–11 Years of Age .....	303
References.....	319
<b>Section 4, Managing Asthma Long Term in Youths <math>\geq</math> 12 Years of Age and Adults .....</b>	<b>326</b>
Key Points: Managing Asthma Long Term in Youths $\geq$ 12 Years of Age and Adults .....	326
<b>Section 4, Stepwise Approach for Managing Asthma in Youths <math>\geq</math> 12 Years of Age and Adults .....</b>	<b>328</b>
Treatment: Principles of Stepwise Therapy in Youths $\geq$ 12 Years of Age and Adults.....	328
Achieving Control of Asthma .....	329
Selecting Initial Therapy for Patients Not Currently Taking Long-Term Control Medications .....	329
Adjusting Therapy.....	329
Impairment Domain .....	330
Risk Domain .....	330
Maintaining Control of Asthma.....	331
Treatment: Pharmacologic Steps .....	333
Intermittent Asthma .....	333
Step 1 Care .....	333
Persistent Asthma .....	334
Step 2 Care, Long-Term Control Medication.....	335
Step 3 Care, Long-Term Control Medications .....	336
Step 4 Care, Long-Term Control Medications .....	338
Step 5 Care, Long-Term Control Medications .....	338
Step 6 Care, Long-Term Control Medications .....	339
Special Issues for Adolescents .....	339
Assessment Issues.....	339
Treatment Issues.....	340

School Issues .....	340
Sports Issues.....	340
Special Issues for Older Adults.....	341
Assessment Issues.....	341
Treatment Issues.....	341
References.....	353
 <b>Section 4, Managing Asthma Long Term—Special Situations .....</b>	<b>362</b>
Introduction .....	362
Exercise-Induced Bronchospasm.....	362
Diagnosis .....	362
Management Strategies .....	363
Surgery and Asthma .....	364
Pregnancy and Asthma .....	364
Racial and Ethnic Disparity in Asthma .....	365
References.....	367
 <b>Section 5, Managing Exacerbations of Asthma .....</b>	<b>372</b>
Key Points: Managing Exacerbations of Asthma .....	372
Key Differences From 1997 and 2002 Expert Panel Reports .....	373
Introduction .....	373
General Considerations.....	375
Treatment Goals .....	377
Home Management of Asthma Exacerbations .....	380
Pre-hospital Management of Asthma Exacerbations .....	383
Emergency Department and Hospital Management of Asthma Exacerbations .....	384
Assessment.....	384
Treatment.....	391
Repeat Assessment .....	395
Hospitalization .....	395
Impending Respiratory Failure.....	396
Patient Discharge .....	398
References.....	405
 <b>For More Information .....</b>	<b>415</b>

**List of Boxes And Figures**

---

FIGURE 1-1. LITERATURE RETRIEVAL AND REVIEW PROCESS: BREAKDOWN BY COMMITTEE .....	4
FIGURE 1-2. LITERATURE RETRIEVAL AND REVIEW PROCESS: OVERALL SUMMARY .....	6
BOX 2-1. CHARACTERISTICS OF CLINICAL ASTHMA.....	12
FIGURE 2-1. THE INTERPLAY AND INTERACTION BETWEEN AIRWAY INFLAMMATION AND THE CLINICAL SYMPTOMS AND PATHOPHYSIOLOGY OF ASTHMA .....	13
FIGURE 2-2. FACTORS LIMITING AIRFLOW IN ACUTE AND PERSISTENT ASTHMA.....	15
BOX 2-2. FEATURES OF AIRWAY REMODELING .....	16
FIGURE 2-3. AIRWAY INFLAMMATION .....	17
FIGURE 2-4. HOST FACTORS AND ENVIRONMENTAL EXPOSURES .....	20
FIGURE 2-5. CYTOKINE BALANCE .....	21
BOX 3-1. KEY INDICATORS FOR CONSIDERING A DIAGNOSIS OF ASTHMA.....	42
BOX 3-2. IMPORTANCE OF SPIROMETRY IN ASTHMA DIAGNOSIS .....	43
BOX 3-3. DIFFERENTIAL DIAGNOSTIC POSSIBILITIES FOR ASTHMA .....	46
BOX 3-4. INSTRUMENTS FOR ASSESSING ASTHMA-SPECIFIC AND GENERIC QUALITY OF LIFE .....	62
FIGURE 3-1. SUGGESTED ITEMS FOR MEDICAL HISTORY* .....	69
FIGURE 3-2. SAMPLE QUESTIONS* FOR THE DIAGNOSIS AND INITIAL ASSESSMENT OF ASTHMA .....	70
FIGURE 3-3a. SAMPLE SPIROMETRY VOLUME TIME AND FLOW VOLUME CURVES .....	71
FIGURE 3-3b. REPORT OF SPIROMETRY FINDINGS PRE- AND POSTBRONCHODILATOR .....	71
FIGURE 3-4a. CLASSIFYING ASTHMA SEVERITY IN CHILDREN 0–4 YEARS OF AGE .....	72
FIGURE 3-4b. CLASSIFYING ASTHMA SEVERITY IN CHILDREN 5–11 YEARS OF AGE .....	73
FIGURE 3-4c. CLASSIFYING ASTHMA SEVERITY IN YOUTHS ≥12 YEARS OF AGE AND ADULTS.....	74
FIGURE 3-5a. ASSESSING ASTHMA CONTROL IN CHILDREN 0–4 YEARS OF AGE .....	75
FIGURE 3-5b. ASSESSING ASTHMA CONTROL IN CHILDREN 5–11 YEARS OF AGE .....	76
FIGURE 3-5c. ASSESSING ASTHMA CONTROL IN YOUTHS ≥12 YEARS OF AGE AND ADULTS.....	77
FIGURE 3-6. SAMPLE QUESTIONS FOR ASSESSING AND MONITORING ASTHMA CONTROL.....	78
FIGURE 3-7. COMPONENTS OF THE CLINICIAN'S FOLLOWUP ASSESSMENT: SAMPLE ROUTINE CLINICAL ASSESSMENT QUESTIONS* .....	79
FIGURE 3-8. VALIDATED INSTRUMENTS FOR ASSESSMENT AND MONITORING OF ASTHMA .....	80
FIGURE 3-9. SAMPLE* PATIENT SELF-ASSESSMENT SHEET FOR FOLLOWUP VISITS .....	81
FIGURE 3-10a. ASTHMA ACTION PLAN .....	117
FIGURE 3-10b. ASTHMA ACTION PLAN .....	118

---

FIGURE 3–10c. ASTHMA ACTION PLAN .....	119
FIGURE 3–11. HOW TO USE YOUR PEAK FLOW METER.....	122
FIGURE 3–12. KEY EDUCATIONAL MESSAGES: TEACH AND REINFORCE AT EVERY OPPORTUNITY .....	124
FIGURE 3–13. DELIVERY OF ASTHMA EDUCATION BY CLINICIANS DURING PATIENT CARE VISITS .....	126
FIGURE 3–14. HOW TO USE YOUR METERED-DOSE INHALER.....	128
FIGURE 3–15. HOW TO CONTROL THINGS THAT MAKE YOUR ASTHMA WORSE .....	129
FIGURE 3–16a. SCHOOL ASTHMA ACTION PLAN .....	137
FIGURE 3–16b. SCHOOL ASTHMA ACTION PLAN .....	139
BOX 3–5. THE STRONG ASSOCIATION BETWEEN SENSITIZATION TO ALLERGENS AND ASTHMA: A SUMMARY OF THE EVIDENCE .....	168
BOX 3–6. RATIONALE FOR ALLERGY TESTING FOR PERENNIAL INDOOR ALLERGENS.....	169
FIGURE 3–17. ASSESSMENT QUESTIONS* FOR ENVIRONMENTAL AND OTHER FACTORS THAT CAN MAKE ASTHMA WORSE .....	186
FIGURE 3–18. COMPARISON OF SKIN TESTS WITH IN VITRO TESTS .....	187
FIGURE 3–19. PATIENT INTERVIEW QUESTIONS* FOR ASSESSING THE CLINICAL SIGNIFICANCE OF POSITIVE ALLERGY TESTS .....	187
FIGURE 3–20. SUMMARY OF MEASURES TO CONTROL ENVIRONMENTAL FACTORS THAT CAN MAKE ASTHMA WORSE .....	188
FIGURE 3–21. EVALUATION AND MANAGEMENT OF WORK-AGGRAVATED ASTHMA AND OCCUPATIONAL ASTHMA .....	189
FIGURE 3–22. LONG-TERM CONTROL MEDICATIONS.....	243
FIGURE 3–23. QUICK-RELIEF MEDICATIONS .....	247
FIGURE 3–24. AEROSOL DELIVERY DEVICES .....	249
BOX 4–1. SAMPLE PATIENT RECORD. MONITORING THE RISK DOMAIN IN CHILDREN: RISK OF ASTHMA PROGRESSION (INCREASED EXACERBATIONS OR NEED FOR DAILY MEDICATION, OR LOSS OF LUNG FUNCTION), AND POTENTIAL ADVERSE EFFECTS OF CORTICOSTEROID THERAPY .....	283
FIGURE 4–1a. STEPWISE APPROACH FOR MANAGING ASTHMA IN CHILDREN 0–4 YEARS OF AGE.....	305
FIGURE 4–1b. STEPWISE APPROACH FOR MANAGING ASTHMA IN CHILDREN 5–11 YEARS OF AGE.....	306
FIGURE 4–2a. CLASSIFYING ASTHMA SEVERITY AND INITIATING TREATMENT IN CHILDREN 0–4 YEARS OF AGE .....	307
FIGURE 4–2b. CLASSIFYING ASTHMA SEVERITY AND INITIATING TREATMENT IN CHILDREN 5–11 YEARS OF AGE .....	308
FIGURE 4–3a. ASSESSING ASTHMA CONTROL AND ADJUSTING THERAPY IN CHILDREN 0–4 YEARS OF AGE .....	309
FIGURE 4–3b. ASSESSING ASTHMA CONTROL AND ADJUSTING THERAPY IN CHILDREN 5–11 YEARS OF AGE .....	310
FIGURE 4–4a. USUAL DOSAGES FOR LONG-TERM CONTROL MEDICATIONS IN CHILDREN* .....	311
FIGURE 4–4b. ESTIMATED COMPARATIVE DAILY DOSAGES FOR INHALED CORTICOSTEROIDS IN CHILDREN .....	314
FIGURE 4–4c. USUAL DOSAGES FOR QUICK-RELIEF MEDICATIONS IN CHILDREN* .....	317

FIGURE 4–5. STEPWISE APPROACH FOR MANAGING ASTHMA IN YOUTHS ≥12 YEARS OF AGE AND ADULTS .....	343
FIGURE 4–6. CLASSIFYING ASTHMA SEVERITY AND INITIATING TREATMENT IN YOUTHS ≥12 YEARS OF AGE AND ADULTS .....	344
FIGURE 4–7. ASSESSING ASTHMA CONTROL AND ADJUSTING THERAPY IN YOUTHS ≥12 YEARS OF AGE AND ADULTS .....	345
FIGURE 4–8a. USUAL DOSAGES FOR LONG-TERM CONTROL MEDICATIONS FOR YOUTHS ≥12 YEARS OF AGE AND ADULTS .....	346
FIGURE 4–8b. ESTIMATED COMPARATIVE DAILY DOSAGES FOR INHALED CORTICOSTEROIDS FOR YOUTHS ≥12 YEARS OF AGE AND ADULTS .....	349
FIGURE 4–8c.USUAL DOSAGES FOR QUICK-RELIEF MEDICATIONS FOR YOUTHS ≥12 YEARS OF AGE AND ADULTS .....	351
FIGURE 5–1. CLASSIFYING SEVERITY OF ASTHMA EXACERBATIONS IN THE URGENT OR EMERGENCY CARE SETTING .....	374
FIGURE 5–2a. RISK FACTORS FOR DEATH FROM ASTHMA .....	376
FIGURE 5–2b. SPECIAL CONSIDERATIONS FOR INFANTS .....	377
FIGURE 5–3. FORMAL EVALUATION OF ASTHMA EXACERBATION SEVERITY IN THE URGENT OR EMERGENCY CARE SETTING .....	379
FIGURE 5–4. MANAGEMENT OF ASTHMA EXACERBATIONS: HOME TREATMENT.....	381
FIGURE 5–5. DOSAGES OF DRUGS FOR ASTHMA EXACERBATIONS .....	385
FIGURE 5–6. MANAGEMENT OF ASTHMA EXACERBATIONS: EMERGENCY DEPARTMENT AND HOSPITAL-BASED CARE .....	387
FIGURE 5–7a. EMERGENCY DEPARTMENT—ASTHMA DISCHARGE PLAN .....	401
FIGURE 5–7b. EMERGENCY DEPARTMENT—ASTHMA DISCHARGE PLAN: HOW TO USE YOUR METERED-DOSE INHALER .....	402
FIGURE 5–8. CHECKLIST FOR HOSPITAL DISCHARGE OF PATIENTS WHO HAVE ASTHMA .....	404

## ACKNOWLEDGMENTS AND FINANCIAL DISCLOSURES

### External Review and Comment Overview

In response to a recommendation by the National Asthma Education and Prevention Program (NAEPP) Coordinating Committee, an Expert Panel was convened by the National Heart, Lung, and Blood Institute (NHLBI) to update the asthma guidelines.

Several measures were taken in the development of these asthma guidelines to enhance transparency of the evidence review process and to better manage any potential or perceived conflict of interest. In addition to using a methodologist to guide preparation of the Evidence Tables, several layers of external content review were also embedded into the guidelines development process. Expert Panel members and consultant reviewers completed financial disclosure forms that are summarized below. In addition to review by consultants, an early draft of the guidelines was circulated to a panel of guidelines end-users (the Guidelines Implementation Panel) appointed specifically for their review and feedback on ways to enhance guidelines utilization by primary care clinicians, health care delivery organizations, and third-party payors. Finally, a draft of the guidelines was posted on the NHLBI Web Site for review and comment by the NAEPP Coordinating Committee and to allow opportunity for public review and comment before the guidelines were finalized and released.

### NAEPP COORDINATING COMMITTEE

Agency for Healthcare Research and  
Quality  
Denise Dougherty, Ph.D.

Allergy and Asthma Network  
Mothers of Asthmatics  
Nancy Sander

American Academy of Allergy, Asthma,  
and Immunology  
Michael Schatz, M.D., M.S.

American Academy of Family Physicians  
Kurtis S. Elward, M.D., M.P.H., F.A.A.F.P.

American Academy of Pediatrics  
Gary S. Rachelefsky, M.D.

American Academy of Physician Assistants  
Tera Crisalida, P.A.-C., M.P.A.S.

American Association for Respiratory Care  
Thomas J. Kallstrom, R.R.T., F.A.A.R.C.,  
AE-C

American College of Allergy, Asthma, and  
Immunology  
William Storms, M.D.

American College of Chest Physicians  
John Mitchell, M.D., F.A.C.P.

American College of Emergency Physicians  
Richard M. Nowak, M.D., M.B.A.,  
F.A.C.E.P.

American Lung Association  
Noreen M. Clark, Ph.D.

American Medical Association  
Paul V. Williams, M.D.

American Nurses Association  
Karen Huss, D.N.Sc., R.N., A.P.R.N.B.C.,  
F.A.A.N., F.A.A.A.A.I.

American Pharmacists Association  
Dennis M. Williams, Pharm.D.

American Public Health Association  
Pamela J. Luna, Dr.P.H., M.Ed.

American School Health Association  
Lani S. M. Wheeler, M.D., F.A.A.P.,  
F.A.S.H.A.

American Society of Health-System Pharmacists  
Kathryn V. Blake, Pharm.D.

American Thoracic Society  
Stephen C. Lazarus, M.D.

Asthma and Allergy Foundation of America  
Mo Mayrides

Council of State and Territorial Epidemiologists  
Sarah Lyon-Callo, M.A., M.S.

National Association of School Nurses  
Donna Mazyck, R.N., M.S., N.C.S.N.

National Black Nurses Association, Inc.  
Susan B. Clark, R.N., M.N.

National Center for Chronic Disease Prevention, Centers for Disease Control and Prevention (CDC)  
Sarah Merkle, M.P.H.

National Center for Environmental Health, CDC  
Paul M. Garbe, M.D.

National Center for Health Statistics, CDC  
Lara Akinbami, M.D.

National Institute for Occupational Safety and Health, CDC  
Margaret Filios, S.M., R.N.

National Heart, Lung, and Blood Institute  
National Institutes of Health (NIH)  
Elizabeth Nabel, M.D.

National Heart, Lung, and Blood Institute  
NIH, Ad Hoc Committee on Minority Populations  
Ruth I. Quartey, Ph.D.

National Institute of Allergy and Infectious Diseases (NIAID), NIH  
Peter J. Gergen, M.D., M.P.H.

National Institute of Environmental Health Sciences, NIH  
Charles A. Wells, Ph.D.

National Medical Association  
Michael Lenoir, M.D.

National Respiratory Training Center  
Pamela Steele, M.S.N., C.P.N.P., AE-C

Society for Academic Emergency Medicine  
Rita Cydulka, M.D., M.S.

Society for Public Health Education  
Judith C. Taylor-Fishwick, M.Sc., AE-C

U.S. Department of Education  
Dana Carr

U.S. Environmental Protection Agency  
Indoor Environments Division  
David Rowson, M.S.

U.S. Environmental Protection Agency  
Office of Research and Development  
Hillel S. Koren, Ph.D.

U.S. Food and Drug Administration  
Robert J. Meyer, M.D.

### **THIRD EXPERT PANEL ON THE DIAGNOSIS AND MANAGEMENT OF ASTHMA**

William W. Busse, M.D., Chair  
University of Wisconsin Medical School  
Madison, Wisconsin

Homer A. Boushey, M.D.  
University of California–San Francisco  
San Francisco, California

Carlos A. Camargo, Jr., M.D., Dr.P.H.  
Massachusetts General Hospital  
Boston, Massachusetts

David Evans, Ph.D., A.E.-C,  
Columbia University  
New York, New York

Michael B. Foggs, M.D.  
Advocate Health Centers  
Chicago, Illinois

Susan L. Janson, D.N.Sc., R.N., A.N.P.,  
F.A.A.N.  
University of California–San Francisco  
San Francisco, California

H. William Kelly, Pharm.D.  
University of New Mexico Health Sciences  
Center  
Albuquerque, New Mexico

Robert F. Lemanske, M.D.  
University of Wisconsin Hospital and Clinics  
Madison, Wisconsin

Fernando D. Martinez, M.D.  
University of Arizona Medical Center  
Tucson, Arizona

Robert J. Meyer, M.D.  
U.S. Food and Drug Administration  
Silver Spring, Maryland

Harold S. Nelson, M.D.  
National Jewish Medical and Research  
Center  
Denver, Colorado

Thomas A. E. Platts-Mills, M.D., Ph.D.  
University of Virginia School of Medicine  
Charlottesville, Virginia

Michael Schatz, M.D., M.S.  
Kaiser-Permanente–San Diego  
San Diego, California

Gail Shapiro, M.D.<sup>†</sup>  
University of Washington  
Seattle, Washington

Stuart Stoloff, M.D.  
University of Nevada School of Medicine  
Carson City, Nevada

Stanley J. Szefler, M.D.  
National Jewish Medical and Research  
Center  
Denver, Colorado

Scott T. Weiss, M.D., M.S.  
Brigham and Women's Hospital  
Boston, Massachusetts

Barbara P. Yawn, M.D., M.Sc.  
Olmstead Medical Center  
Rochester, Minnesota

---

<sup>†</sup>Deceased

Development of the resource document and the guidelines report was funded by the NHLBI, NIH. Expert Panel members completed financial disclosure forms, and the Expert Panel members disclosed relevant financial interests to each other prior to their discussions. Expert Panel members participated as volunteers and were compensated only for travel expenses related to the Expert Panel meetings. Financial disclosure information covering the 3-year period during which the guidelines were developed is provided for each Panel member below.

Dr. Busse has served on the Speakers' Bureaus of GlaxoSmithKline, Merck, Novartis, and Pfizer; and on the Advisory Boards of Altana, Centocor, Dynavax, Genentech/Novartis, GlaxoSmithKline, Isis, Merck, Pfizer, Schering, and Wyeth. He has received funding/grant support for research projects from Astellas, AstraZeneca, Centocor, Dynavax, GlaxoSmithKline, Novartis, and Wyeth. Dr. Busse also has research support from the NIH.

Dr. Boushey has served as a consultant for Altana, Protein Design Lab, and Sumitomo. He has received honoraria from (Boehringer-Ingelheim, Genentech, Merck, Novartis, and Sanofi-Aventis, and funding/grant support for research projects from the NIH.

Dr. Camargo has served on the Speakers' Bureaus of AstraZeneca, GlaxoSmithKline, Merck, and Schering-Plough; and as a consultant for AstraZeneca, Critical Therapeutics, Dey Laboratories, GlaxoSmithKline, MedImmune, Merck, Novartis, Praxair, Respironics, Schering-Plough, Sepracor, and TEVA. He has received funding/grant support for research projects from a variety of Government agencies and not-for-profit foundations, as well as AstraZeneca, Dey Laboratories, GlaxoSmithKline, MedImmune, Merck, Novartis, and Respironics.

Dr. Evans has received funding/grant support for research projects from the NHLBI.

Dr. Foggs has served on the Speakers' Bureaus of GlaxoSmithKline, Merck, Pfizer, Sepracor, and UCB Pharma; on the Advisory Boards of Alcon, Altana, AstraZeneca, Critical Therapeutics, Genentech, GlaxoSmithKline, and IVAX; and as consultant for Merck and Sepracor. He has received funding/grant support for research projects from GlaxoSmithKline.

Dr. Janson has served on the Advisory Board of Altana, and as a consultant for Merck. She has received funding/grant support for research projects from the NHLBI.

Dr. Kelly has served on the Speakers' Bureaus of AstraZeneca and GlaxoSmithKline; and on the Advisory Boards of AstraZeneca, MAP Pharmaceuticals, Merck, Novartis, and Sepracor.

Dr. Lemanske has served on the Speakers' Bureaus of GlaxoSmithKline and Merck, and as a consultant for AstraZeneca, Aventis, GlaxoSmithKline, Merck, and Novartis. He has received honoraria from Altana, and funding/grant support for research projects from the NHLBI and NIAID.

Dr. Martinez has served on the Advisory Board of Merck and as a consultant for Genentech, GlaxoSmithKline, and Pfizer. He has received honoraria from Merck.

Dr. Meyer has no relevant financial interests.

Dr. Nelson has served on the Speakers' Bureaus of AstraZeneca, GlaxoSmithKline, Pfizer, and Schering-Plough; and as a consultant for Abbott Laboratories, Air Pharma, Altana Pharma US, Astellas, AstraZeneca, Curalogic, Dey Laboratories, Dynavax Technologies, Genentech/Novartis, GlaxoSmithKline, Inflazyme Pharmaceuticals, MedicinaNova, Protein Design Laboratories, Sanofi-Aventis, Schering-Plough, and Wyeth Pharmaceuticals. He has received funding/grant support for research projects from Altana, Astellas, AstraZeneca, Behringwerke, Critical Therapeutics, Dey Laboratories, Epigenesis, Genentech, GlaxoSmithKline, Hoffman LaRoche, IVAX, Medicinova, Novartis, Sanofi-Aventis, Schering-Plough, Sepracor, TEVA, and Wyeth.

Dr. Platts-Mills has served on the Advisory Committee of Indoor Biotechnologies. He has received funding/grant support for a research project from Pharmacia Diagnostics.

Dr. Schatz has served on the Speakers' Bureaus of AstraZeneca, Genentech, GlaxoSmithKline, and Merck; and as a consultant for GlaxoSmithKline on an unbranded asthma initiative. He has received honoraria from AstraZeneca, Genentech, GlaxoSmithKline and Merck. He has received funding/grant support for research projects from GlaxoSmithKline and Merck and Sanofi-Adventis.

Dr. Shapiro<sup>†</sup> served on the Speakers' Bureaus of AstraZeneca, Genentech, GlaxoSmithKline, IVAX Laboratories, Key Pharmaceuticals, Merck, Pfizer Pharmaceuticals, Schering Corporation, UCB Pharma, and 3M; and as a consultant for Altana, AstraZeneca, Dey Laboratories, Genentech/Novartis, GlaxoSmithKline, ICOS, IVAX Laboratories, Merck, Sanofi-Aventis, and Sepracor. She received funding/grant support for research projects from Abbott, AstraZeneca, Boehringer Ingelheim, Bristol-Myers-Squibb, Dey Laboratories, Fujisawa Pharmaceuticals, Genentech, GlaxoSmithKline, Immunex, Key, Lederle, Lilly Research, MedPointe Pharmaceuticals, Medtronic Emergency Response Systems, Merck, Novartis, Pfizer, Pharmaxis, Purdue Frederick, Sanofi-Aventis, Schering, Sepracor, 3M Pharmaceuticals, UCB Pharma, and Upjohn Laboratories.

Dr. Stoloff has served on the Speakers' Bureaus of Alcon, Altana, AstraZeneca, Genentech, GlaxoSmithKline, Novartis, Pfizer, Sanofi-Aventis, and Schering; and as a consultant for Alcon, Altana, AstraZeneca, Dey, Genentech, GlaxoSmithKline, Merck, Novartis, Pfizer, Sanofi-Aventis, and Schering.

Dr. Szeffler has served on the Advisory Boards of Altana, AstraZeneca, Genentech, GlaxoSmithKline, Merck, Novartis, and Sanofi-Aventis; and as a consultant for Altana, AstraZeneca, Genentech, GlaxoSmithKline, Merck, Novartis, and Sanofi-Aventis. He has received funding/grant support for a research project from Ross.

Dr. Weiss has served on the Advisory Board of Genentech, and as a consultant for Genentech and GlaxoSmithKline. He has received funding/grant support for research projects from GlaxoSmithKline.

Dr. Yawn has served on the Advisory Boards of Altana, AstraZeneca, Merck, Sanofi-Aventis, and Schering-Plough. She has received honoraria from Pfizer and Schering-Plough, and funding/grant support for research projects from the Agency for Healthcare Research and Quality, the CDC, the NHLBI, Merck, and Schering-Plough.

---

<sup>†</sup>Deceased

## CONSULTANT REVIEWERS

The Expert Panel acknowledges the following consultants for their review of an early draft of the report. Financial disclosure information covering a 12-month period prior to the review of the guidelines is provided below for each consultant.

Andrea J. Apter, M.D., M.Sc.  
University of Pennsylvania Medical Center  
Philadelphia, Pennsylvania

Noreen M. Clark, Ph.D.  
University of Michigan School of Public  
Health  
Ann Arbor, Michigan

Anne Fuhlbrigge, M.D., M.S.  
Brigham and Women's Hospital  
Boston, Massachusetts

Elliott Israel, M.D.  
Brigham and Women's Hospital  
Boston, Massachusetts

Meyer Kattan, M.D.  
Mount Sinai Medical Center  
New York, New York

Jerry A. Krishnan, M.D., Ph.D.  
The Johns Hopkins School of Medicine  
Baltimore, Maryland

James T. Li, M.D., Ph.D., F.A.A.A.A.I.  
Mayo Clinic  
Rochester, Minnesota

Dennis R. Ownby, M.D.  
Medical College of Georgia  
Augusta, Georgia

Gary S. Rachelefshy, M.D.  
University of California-Los Angeles,  
School of Medicine  
Los Angeles, California

Brian H. Rowe, M.D., M.Sc., C.C.F.P.  
(E.M.), F.C.C.P.  
University of Alberta Hospital  
Edmonton, Alberta, Canada

E. Rand Sutherland, M.D., M.P.H.  
National Jewish Medical and Research  
Center  
Denver, Colorado

Sandra R. Wilson, Ph.D.  
Palo Alto Medical Foundation  
Palo Alto, California

Robert A. Wood, M.D.  
The Johns Hopkins School of Medicine  
Baltimore, Maryland

Robert Zeiger, M.D.  
Kaiser Permanente Medical Center  
San Diego, California

Dr. Apter owns stock in Johnson & Johnson. She has received funding/grant support for research projects from the NHLBI.

Dr. Clark has no relevant financial interests.

Dr. Fuhlbrigge has served on the Speakers' Bureau of GlaxoSmithKline, the Advisory Boards of GlaxoSmithKline and Merck, the Data Systems Monitoring Board for a clinical trial sponsored by Sepracor, and as a consultant for GlaxoSmithKline. She has received honoraria from GlaxoSmithKline and Merck, and funding/grant support for a research project from Boehringer Ingelheim.

Dr. Israel has served on the Speakers' Bureau of Genentech and Merck, and as a consultant for Asthmatx, Critical Therapeutics, Genentech, Merck, Novartis Pharmaceuticals, Protein Design Labs, Schering-Plough Company, and Wyeth. He has received funding/grant support for research projects from Asthmatx, Boehringer Ingelheim, Centocor, Genentech, GlaxoSmithKline, and Merck.

Dr. Kattan has served on the Speakers' Bureau of AstraZeneca.

Dr. Krishnan has received funding/grant support for a research project from Hill-Rom, Inc.

Dr. Li has received funding/grant support for research projects from the American Lung Association, GlaxoSmithKline, Pharming, and ZLB Behring.

Dr. Ownby has none.

Dr. Rachelefsky has served on the Speakers' Bureaus of AstraZeneca, GlaxoSmithKline, IVAX, Medpointe, Merck, and Schering-Plough. He has received honoraria from AstraZeneca, GlaxoSmithKline, IVAX, Medpointe, Merck, and Schering-Plough.

Dr. Rowe has served on the Advisory Boards of Abbott, AstraZeneca, Boehringer Ingelheim, and GlaxoSmithKline. He has received honoraria from Abbott, AstraZeneca, Boehringer Ingelheim, and GlaxoSmithKline. He has received funding/grant support for research projects from Abbott, AstraZeneca, Boehringer Ingelheim, GlaxoSmithKline, and Trudell.

Dr. Sutherland has served on the Speakers' Bureau of Novartis/Genentech and the Advisory Board of Dey Laboratories. He has received honoraria from IVAX and funding/grant support for research projects from GlaxoSmithKline and the NIH.

Dr. Wilson has served as a consultant for the Department of Urology, University of California, San Francisco (UCSF); Asthmatx, Inc.; and the Stanford-UCSF Evidence-Based Practice Center. She has received funding/grant support for research projects from the NHLBI and from a subcontract to Stanford University from Blue Shield Foundation.

Dr. Wood has served on the Speakers' Bureaus of Dey Laboratories, GlaxoSmithKline, and Merck; on the Advisory Board of Dey Laboratories; and as a consultant to Dey Laboratories. He has received honoraria from Dey Laboratories, GlaxoSmithKline, and Merck, and funding/grant support for a research project from Genentech.

Dr. Zeiger has served on the Data Monitoring Board of Genentech, Advisory Board of GlaxoSmithKline, and as a consultant for Aerocrine, AstraZeneca, and Genentech. He has received honoraria from AstraZeneca and funding/grant support for a research project from Sanofi-Aventis.

### **National Heart, Lung, and Blood Institute Staff**

Robinson (Rob) Fulwood, Ph.D., M.S.P.H.  
Chief, Enhanced Dissemination and  
Utilization Branch  
Division for the Application of Research  
Discoveries

James P. Kiley, Ph.D.  
Director  
Division of Lung Diseases

Gregory J. Morosco, Ph.D., M.P.H.  
Associate Director for Prevention,  
Education, and Control  
Director  
Division for the Application of Research  
Discoveries

Diana K. Schmidt, M.P.H.  
Coordinator  
National Asthma Education and Prevention  
Program  
Division for the Application of Research  
Discoveries

Virginia S. Taggart, M.P.H.  
Program Director  
Division of Lung Diseases

### **American Institutes for Research Staff**

Heather Banks, M.A., M.A.T.  
Senior Editor

Patti Louthian  
Senior Desktop Publisher

Karen L. Soeken, Ph.D.  
Methodologist

Mary Tierney, M.D.  
Project Manager

## ACRONYMS AND ABBREVIATIONS

AAI	acute asthma index
<i>A. artemisiifolia</i>	<i>Ambrosia artemisiifolia</i>
ABG	arterial blood gas
ABPA	allergic bronchopulmonary aspergillosis
ACE	angiotensin converting enzyme
ACIP	Advisory Committee on Immunization Practices (CDC)
ACT	Asthma Control Test
AHRQ	Agency for Healthcare Research and Quality
ALT	alanine aminotransferase (enzyme test of liver function)
Amb a 1	<i>Ambrosia artemisiifolia</i>
AQLQ	asthma-related quality of life questionnaire
ATAQ	Asthma Therapy Assessment Questionnaire
ATS	American Thoracic Society
BDP	beclomethasone dipropionate
Bla g1	<i>Blattella germanica</i> 1 (cockroach allergen)
BMD	bone mineral density
BPT	bronchial provocation test
CAMP	Childhood Asthma Management Program
CBC	complete blood count
CC	Coordinating Committee
CDC	Centers for Disease Control and Prevention
CFC	chlorofluorocarbon (inhaler propellant being phased out because it harms atmosphere)
CI	confidence interval
COPD	chronic obstructive pulmonary disease
COX-2	cyclooxygenase (an enzyme)
CPAP	continuous positive airway pressure
CT	computer tomography
Der f	<i>Dermatophagoides farinae</i> (American house-dust mite)
Der p	<i>Dermatophagoides pteronyssinus</i> (European house-dust mite)
DEXA	dual energy x-ray absorptiometry
DHHS	U.S. Department of Health and Human Services
DPI	dry powder inhaler
EBC	exhaled breath concentrate
ECP	eosinophilic cationic protein
ED	emergency department
EIB	exercise-induced bronchospasm
EMS	emergency medical services
eNO	exhaled nitric oxide
EPR	Expert Panel Report EPR 1991, EPR 1997 (EPR—2), EPR—Update 2002, EPR—3: Full Report 2007 (this 2007 guidelines update)
ER	emergency room
ERS	European Respiratory Society
ETS	environmental tobacco smoke

FC $\square$ RI	high-affinity IgE receptor
FDA	U.S. Food and Drug Administration
FEF	forced expiratory flow
FEF <sub>25–75</sub>	forced expiratory flow between 25 percent and 75 percent of the vital capacity
FeNO	fractional exhaled nitric oxide
FEV <sub>1</sub>	forced expiratory volume in 1 second
FEV <sub>6</sub>	forced expiratory volume in 6 seconds
FiO <sub>2</sub>	fractional inspired oxygen
FRC	functional residual capacity
FVC	forced vital capacity
GERD	gastroesophageal reflux disease
GINA	Global Initiative for Asthma
GIP	Guidelines Implementation Panel (at NHLBI)
GM-CSF	granulocyte-macrophage colony-stimulating factor
HEPA	high-efficiency particulate air (a type of filter)
HFA	hydrofluoroalkane (inhaler propellant)
HMO	health maintenance organization
HPA	hypothalamic-pituitary-adrenal (usually used with "axis")
HRT	hormone replacement therapy
ICS	inhaled corticosteroid(s)
ICU	intensive care unit
IFN- $\square$	interferon-gamma
IgE	immunoglobulin E (and similar types, such as IgG)
IL-4, IL-12, etc.	interleukin-4, interleukin-12 (and similar)
IL-4R	interleukin-4 receptor (and similar)
INR	international normalized ratio
IVIG	intravenous immunoglobulin
IVMg	intravenous magnesium sulfate
LABA/LABAs	long-acting beta <sub>2</sub> -agonist(s)
LTRA	leukotriene receptor antagonist
Mab or MAb	monoclonal antibody
MDC	macrophage-derived chemokines
MDI	metered-dose inhaler
MDI/DED	metered-dose inhaler (MDI) with delivery enhancement device (DED)
MeSH	Medical Subject Headings (in MEDLINE)
MIP	macrophage inflammatory protein
NAEPP	National Asthma Education and Prevention Program
NCHS	National Center for Health Statistics
NHANES	National Health and Nutrition Examination Survey (with roman numeral)
NHIS	National Health Information Survey
NHLBI	National Heart, Lung, and Blood Institute
NIH	National Institutes of Health
NK	natural killer cells

NO or NO <sub>2</sub>	nitric oxide
NSAID	nonsteroidal anti-inflammatory drug
OR	odds ratio
OSA	obstructive sleep apnea
PCO <sub>2</sub>	partial pressure of carbon dioxide
PCP	primary care provider (or physician)
PD20	20 percent of provocative dose
PEF	peak expiratory flow
PEFR	PEF rate
PI	pulmonary index
PI <sub>max</sub>	maximal pulmonary inspiration
PICU	pediatric intensive care unit
PIV	parainfluenza virus
PM10	particulate matter ≤10 micrometers
RANTES	Regulated on Activation, Normal T Expressed and Secreted
RCT	randomized controlled trial
RR	relative risk
RSV	respiratory syncytial virus
RV	residual volume
SABA/SABAs	short-acting beta <sub>2</sub> -agonist(s) (inhaled)
SaO <sub>2</sub>	oxygen saturation
SMART	Salmeterol Multicenter Asthma Research Trial
START	Inhaled Steroid Treatment as Regular Therapy in Early Asthma study
TAA	triamcinolone acetonide
TAO	troleandomycin (antibiotic)
Th1, Th2	T cell helper 1, T cell helper 2
TLC	total lung capacity
TNF-□	tumor necrosis factor-alpha
TRUST	The Regular Use of Salbutamol Trial
USDA	U.S. Department of Agriculture
VC	vital capacity
VCD	vocal cord dysfunction
VHC	valved holding chamber
VOC	volatile organic compounds (e.g., benzene)

## PREFACE

The Expert Panel Report 3 (EPR-3) Full Report 2007: Guidelines for the Diagnosis and Management of Asthma was developed by an expert panel commissioned by the National Asthma Education and Prevention Program (NAEPP) Coordinating Committee (CC), coordinated by the National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health.

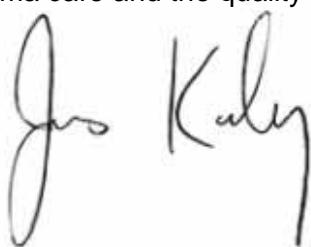
Using the 1997 EPR-2 guidelines and the 2002 update on selected topics as the framework, the expert panel organized the literature review and updated recommendations for managing asthma long term and for managing exacerbations around four essential components of asthma care, namely: assessment and monitoring, patient education, control of factors contributing to asthma severity, and pharmacologic treatment. Subtopics were developed for each of these four broad categories.

The EPR-3 Full Report has been developed under the excellent leadership of Dr. William Busse, Panel Chair. The NHLBI is grateful for the tremendous dedication of time and outstanding work of all the members of the expert panel, and for the advice from an expert consultant group in developing this report. Sincere appreciation is also extended to the NAEPP CC and the Guidelines Implementation Panel as well as other stakeholder groups (professional societies, voluntary health, government, consumer/patient advocacy organizations, and industry) for their invaluable comments during the public review period that helped to enhance the scientific credibility and practical utility of this document.

Ultimately, the broad change in clinical practice depends on the influence of local primary care physicians and other health professionals who not only provide state-of-the-art care to their patients, but also communicate to their peers the importance of doing the same. The NHLBI and its partners will forge new initiatives based on these guidelines to stimulate adoption of the recommendations at all levels, but particularly with primary care clinicians at the community level. We ask for the assistance of every reader in reaching our ultimate goal: improving asthma care and the quality of life for every asthma patient with asthma.



Gregory Morosco, Ph.D., M.P.H.  
Director  
Division for the Application of Research  
Discoveries  
National Heart, Lung, and Blood Institute



James Kiley, Ph.D.  
Director  
Division of Lung Diseases  
National Heart, Lung, and Blood  
Institute