

# Respiratory Disease in Agricultural Workers: Mortality and Morbidity Statistics



February 2007

**DEPARTMENT OF HEALTH AND HUMAN SERVICES**  
Centers for Disease Control and Prevention  
National Institute for Occupational Safety and Health

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# Table of Contents

<i>Preface</i> .....	<i>iv</i>
<i>Acknowledgements</i> .....	<i>v</i>
<i>Abbreviations</i> .....	<i>vi</i>
<i>List of Tables and Figures</i> .....	<i>vii</i>
<i>Highlights and Limitations</i> .....	<i>xxiii</i>
<i>Highlights</i> .....	<i>xxv</i>
<i>Limitations</i> .....	<i>xxix</i>
Section 1. Demographics .....	1
Section 2. Mortality .....	9
Section 3. Morbidity .....	177
NHIS .....	179
NHANES .....	195
SOII .....	256
Section 4. Recommendations for Future Studies .....	259
Appendix A. Sources of Data .....	A-1
Appendix B. Methods .....	B-1
Appendix C. ICD-9 Codes and Descriptions for Respiratory Diseases Included in the Mortality Analysis .....	C-1
Appendix D. States and Years with Industry and Occupation Codes from Death Certificates Used in the Mortality Analysis, 1988–1998 .....	D-1
Appendix E. Agricultural Groups Used in the Mortality Analysis and Their Derivation from the U.S. Bureau of Census Industry and Occupation Codes .....	E-1
Appendix F. Agricultural Groups Used in the Morbidity Analysis and Their Derivation from the National Health and Interview Survey (NHIS) Industry and Occupation Codes ..	F-1
Appendix G. Agricultural Groups Used in the Morbidity Analysis and Their Derivation from the Third National Health and Nutrition Examination Survey (NHANES III) Industry and Occupation Codes ..	G-1

## Preface

*Respiratory Disease in Agriculture: Mortality and Morbidity Statistics* presents summary tables and figures of occupational respiratory disease surveillance data focusing on various occupationally relevant respiratory diseases for the Agriculture, Forestry, and Fishing industries. The report has seven major sections that provide the following data: (1) highlights and data usage limitations; (2) demographic statistics for agricultural workers; (3) mortality statistics for agricultural workers, including by sex and race/ethnicity; (4) morbidity statistics for agricultural workers, including by sex, race/ethnicity, smoking status, and source of data; (5) recommendations to fill research gaps for respiratory disease in agriculture; and (6) appendices with descriptions of data sources, methods, and other supplementary information.

Data contained in this report originate from various publications, reports, data files, and tabulations provided by the National Center for Health Statistics (NCHS) and the Bureau of Labor Statistics (BLS). Details on the major data sources and on the methods used to compute specific statistics can be found in Appendices A and B, respectively.

Interpreted with appropriate caution, the information contained in this report can help to establish priorities for research and respiratory disease prevention in agriculture. To increase the utility of future surveillance of occupational respiratory disease in agriculture, comments on the report, descriptions of how the information could be used, and suggestions of other data for inclusion in future reports are invited.

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Drafts of this report were provided for review and comment to epidemiologists, physicians, industrial hygienists, agricultural health experts, and representatives of industry and labor associations. Their comments have been considered in preparing the final version of this report.

# Abbreviations

BLS	Bureau of Labor Statistics
CDC	Centers for Disease Control and Prevention
DHHS	Department of Health and Human Services
FEV <sub>1</sub>	forced expiratory volume in one second
FVC	forced vital capacity
ICD	International Classification of Diseases
L	liters
LCL	lower confidence limit
LLN	lower limit of normal
L/sec	liters per second
NCHS	National Center for Health Statistics
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Interview Survey
NIOSH	National Institute for Occupational Safety and Health
PEF	peak expiratory flow
PMR	proportionate mortality ratio
PR	prevalence ratio
SD	standard deviation
SOII	Survey of Occupational Injuries and Illnesses
UCL	upper confidence limit

# List of Tables and Figures

## Demographics

Table 1-1. Demographic characteristics of employed U.S. agricultural workers by agricultural group and occupation, 2002 . . . . .	3
Figure 1-1. Distribution of employed U.S. agricultural workers by sex, race, and ethnicity in comparison to all U.S. workers, 1997 and 2002 . . . . .	4
Figure 1-2. Distribution of employed U.S. agricultural groups by sex, race, and ethnicity, 1997 . . . . .	5
Figure 1-3. Distribution of employed U.S. agricultural groups by sex, race, and ethnicity, 2002 . . . . .	6
Table 1-2. Distribution of employed U.S. agricultural workers by state, 2002. . . . .	7

## Mortality

### Mortality by Disease Category within Agricultural Group

Table 2-1. Crop farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	11
Table 2-2. Livestock farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	12
Table 2-3. Farm managers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	13
Table 2-4. Landscape and horticultural workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	14
Table 2-5. Forestry workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	15
Table 2-6. Fishery workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	16

### Mortality by Agricultural Group within Disease Category

Figure 2-1. Tuberculosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	17
Figure 2-2. Mycoses: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	18
Figure 2-3. Sarcoidosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	19
Figure 2-4. Malignant neoplasms of trachea/bronchus/lung/pleura: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	20
Figure 2-5. Acute respiratory infections: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	21
Figure 2-6. Other diseases of upper respiratory tract: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	22

## List of Tables and Figures

---

Figure 2-7. Pneumonia and influenza: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	23
Figure 2-8. Chronic obstructive pulmonary disease and allied conditions: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	24
Figure 2-9. Pneumoconioses and other lung diseases—external agents: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	25
Figure 2-10. Other diseases of respiratory system: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	26

### Mortality by Disease Category within Agricultural and Sex Group

Table 2-7. Crop farm workers, males: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	27
Table 2-8. Livestock farm workers, males: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	28
Table 2-9. Farm managers, males: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	29
Table 2-10. Landscape and horticultural workers, males: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	30
Table 2-11. Forestry workers, males: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	31
Table 2-12. Fishery workers, males: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	32
Table 2-13. Crop farm workers, females: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	33
Table 2-14. Livestock farm workers, females: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	34
Table 2-15. Farm managers, females: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	35
Table 2-16. Landscape and horticultural workers, females: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	36
Table 2-17. Forestry workers, females: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	37
Table 2-18. Fishery workers, females: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	38

### Mortality by Agricultural Group and Sex within Disease Category

Figure 2-11. Tuberculosis: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by agricultural group and sex, U.S. residents age 15 and over, selected states, 1988–1998. . . . .	39
---	----



Figure 2-12. Mycoses: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by agricultural group and sex, U.S. residents age 15 and over, selected states, 1988–1998. . . . . 40

Figure 2-13. Sarcoidosis: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by agricultural group and sex, U.S. residents age 15 and over, selected states, 1988–1998. . . . . 41

Figure 2-14. Malignant neoplasms of trachea/bronchus/lung/pleura: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by agricultural group and sex, U.S. residents age 15 and over, selected states, 1988–1998. . . . . 42

Figure 2-15. Acute respiratory infections: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by agricultural group and sex, U.S. residents age 15 and over, selected states, 1988–1998. . . . . 43

Figure 2-16. Other diseases of upper respiratory tract: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by agricultural group and sex, U.S. residents age 15 and over, selected states, 1988–1998 . 44

Figure 2-17. Pneumonia and influenza: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by agricultural group and sex, U.S. residents age 15 and over, selected states, 1988–1998. . . . . 45

Figure 2-18. Chronic obstructive pulmonary disease and allied conditions: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by agricultural group and sex, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 46

Figure 2-19. Pneumoconioses and other lung diseases—external agents: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by agricultural group and sex, U.S. residents age 15 and over, selected states, 1988–1998. . . . . 47

Figure 2-20. Other diseases of respiratory system: Proportionate mortality ratio (PMR) adjusted for age and race/ethnicity by agricultural group and sex, U.S. residents age 15 and over, selected states, 1988–1998. . . 48

**Mortality by Disease Category within Agricultural and Race/Ethnicity Group**

Table 2-19. Crop farm workers, white, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 49

Table 2-20. Livestock farm workers, white, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 50

Table 2-21. Farm managers, white, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . . 51

Table 2-22. Landscape and horticultural workers, white, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . 52

Table 2-23. Forestry workers, white, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . . 53

Table 2-24. Fishery workers, white, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998. . . . . 54

Table 2-25. Crop farm workers, black, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 55

Table 2-26. Livestock farm workers, black, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 56

## List of Tables and Figures

---

Table 2-27. Farm managers, black, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	57
Table 2-28. Landscape and horticultural workers, black, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	58
Table 2-29. Forestry workers, black, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	59
Table 2-30. Fishery workers, black, non-Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	60
Table 2-31. Crop farm workers, Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	61
Table 2-32. Livestock farm workers, Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	62
Table 2-33. Farm managers, Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	63
Table 2-34. Landscape and horticultural workers, Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	64
Table 2-35. Forestry workers, Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	65
Table 2-36. Fishery workers, Hispanic: Proportionate mortality ratio (PMR) adjusted for age and sex by disease category, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	66

### **Mortality by Agricultural Group and Race/Ethnicity within Disease Category**

Figure 2-21. Tuberculosis: Proportionate mortality ratio (PMR) adjusted for age and sex by agricultural group and race/ethnicity, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	67
Figure 2-22. Mycoses: Proportionate mortality ratio (PMR) adjusted for age and sex by agricultural group and race/ethnicity, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	68
Figure 2-23. Sarcoidosis: Proportionate mortality ratio (PMR) adjusted for age and sex by agricultural group and race/ethnicity, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	69
Figure 2-24. Malignant neoplasms of trachea/bronchus/lung/pleura: Proportionate mortality ratio (PMR) adjusted for age and sex by agricultural group and race/ethnicity, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	70
Figure 2-25. Acute respiratory infections: Proportionate mortality ratio (PMR) adjusted for age and sex by agricultural group and race/ethnicity, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	71
Figure 2-26. Other diseases of upper respiratory tract: Proportionate mortality ratio (PMR) adjusted for age and sex by agricultural group and race/ethnicity, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	72
Figure 2-27. Pneumonia and influenza: Proportionate mortality ratio (PMR) adjusted for age and sex by agricultural group and race/ethnicity, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	73

Figure 2-28. Chronic obstructive pulmonary disease and allied conditions: Proportionate mortality ratio (PMR) adjusted for age and sex by agricultural group and race/ethnicity, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 74

Figure 2-29. Pneumoconioses and other lung diseases—external agents: Proportionate mortality ratio (PMR) adjusted for age and sex by agricultural group and race/ethnicity, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 75

Figure 2-30. Other diseases of respiratory system: Proportionate mortality ratio (PMR) adjusted for age and sex by agricultural group and race/ethnicity, U.S. residents age 15 and over, selected states, 1988–1998 . . . 76

**Tuberculosis Mortality within and by Agricultural Group**

Table 2-37. Crop farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for tuberculosis, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 77

Table 2-38. Livestock farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for tuberculosis, U.S. residents age 15 and over, selected states, 1988–1998. . . . . 78

Table 2-39. Farm managers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for tuberculosis, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 79

Table 2-40. Landscape and horticultural workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for tuberculosis, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 80

Table 2-41. Forestry workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for tuberculosis, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 81

Table 2-42. Fishery workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for tuberculosis, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 82

Figure 2-31. Pulmonary tuberculosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 83

Figure 2-32. Other respiratory tuberculosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 84

Figure 2-33. Tuberculosis of meninges and central nervous system: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 85

Figure 2-34. Tuberculosis of bones and joints: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 86

Figure 2-35. Tuberculosis of other organs: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 87

Figure 2-36. Miliary tuberculosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 88

**Mycoses Mortality within and by Agricultural Group**

Table 2-43. Crop farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for mycoses, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 89

## List of Tables and Figures

---

Table 2-44. Livestock farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for mycoses, U.S. residents age 15 and over, selected states, 1988–1998 .....	90
Table 2-45. Farm managers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for mycoses, U.S. residents age 15 and over, selected states, 1988–1998.....	91
Table 2-46. Landscape and horticultural workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for mycoses, U.S. residents age 15 and over, selected states, 1988–1998 .....	92
Table 2-47. Forestry workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for mycoses, U.S. residents age 15 and over, selected states, 1988–1998 .....	93
Table 2-48. Fishery workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for mycoses, U.S. residents age 15 and over, selected states, 1988–1998 .....	94
Figure 2-37. Candidiasis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 .....	95
Figure 2-38. Histoplasmosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 .....	96
Figure 2-39. Blastomycotic infection: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 .....	97
Figure 2-40. Other mycoses: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 .....	98

### **Malignant Neoplasm of Trachea/Bronchus/Lung/Pleura Mortality within and by Agricultural Group**

Table 2-49. Crop farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for malignant neoplasms of trachea/bronchus/lung/pleura, U.S. residents age 15 and over, selected states, 1988–1998 .....	99
Table 2-50. Livestock farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for malignant neoplasms of trachea/bronchus/lung/pleura, U.S. residents age 15 and over, selected states, 1988–1998.....	100
Table 2-51. Farm managers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for malignant neoplasms of trachea/bronchus/lung/pleura, U.S. residents age 15 and over, selected states, 1988–1998 .....	101
Table 2-52. Landscape and horticultural workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for malignant neoplasms of trachea/bronchus/lung/pleura, U.S. residents age 15 and over, selected states, 1988–1998 .....	102
Table 2-53. Forestry workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for malignant neoplasms of trachea/bronchus/lung/pleura, U.S. residents age 15 and over, selected states, 1988–1998 .....	103
Table 2-54. Fishery workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for malignant neoplasms of trachea/bronchus/lung/pleura, U.S. residents age 15 and over, selected states, 1988–1998 .....	104

Figure 2-41. Malignant neoplasm of trachea, bronchus, and lung: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 105

Figure 2-42. Malignant neoplasm of pleura: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 106

**Acute Respiratory Infection Mortality within and by Agricultural Group**

Table 2-55. Crop farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for acute respiratory infections, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 107

Table 2-56. Livestock farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for acute respiratory infections, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 108

Table 2-57. Farm managers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for acute respiratory infections, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 109

Table 2-58. Landscape and horticultural workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for acute respiratory infections, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 110

Table 2-59. Forestry workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for acute respiratory infections, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 111

Table 2-60. Fishery workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for acute respiratory infections, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 112

Figure 2-43. Acute laryngitis and tracheitis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 113

Figure 2-44. Acute upper respiratory infections of multiple or unspecified sites: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 114

Figure 2-45. Acute bronchitis and bronchiolitis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 115

**Other Diseases of Upper Respiratory Tract Mortality within and by Agricultural Group**

Table 2-61. Crop farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of upper respiratory tract, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 116

Table 2-62. Livestock farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of upper respiratory tract, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 117

Table 2-63. Farm managers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of upper respiratory tract, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 118

Table 2-64. Landscape and horticultural workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of upper respiratory tract, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 119

## List of Tables and Figures

---

- Table 2-65. Forestry workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of upper respiratory tract, U.S. residents age 15 and over, selected states, 1988–1998 . . . 120
- Table 2-66. Fishery workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of upper respiratory tract, U.S. residents age 15 and over, selected states, 1988–1998 . . . 121
- Figure 2-46. Chronic sinusitis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 122
- Figure 2-47. Other diseases of upper respiratory tract: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . 123

### **Pneumonia and Influenza Mortality within and by Agricultural Group**

- Table 2-67. Crop farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumonia and influenza, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 124
- Table 2-68. Livestock farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumonia and influenza, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 125
- Table 2-69. Farm managers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumonia and influenza, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 126
- Table 2-70. Landscape and horticultural workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumonia and influenza, U.S. residents age 15 and over, selected states, 1988–1998 . . . 127
- Table 2-71. Forestry workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumonia and influenza, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 128
- Table 2-72. Fishery workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumonia and influenza, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 129
- Figure 2-48. Viral pneumonia: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 130
- Figure 2-49. Pneumococcal pneumonia: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 131
- Figure 2-50. Other bacterial pneumonia: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 132
- Figure 2-51. Pneumonia due to other specified organism: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 133
- Figure 2-52. Bronchopneumonia, organism unspecified: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 134
- Figure 2-53. Pneumonia, organism unspecified: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 135
- Figure 2-54. Influenza: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 136

---

---

**COPD Mortality within and by Agricultural Group**

Table 2-73. Crop farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for chronic obstructive pulmonary disease and allied conditions, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 137

Table 2-74. Livestock farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for chronic obstructive pulmonary disease and allied conditions, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 138

Table 2-75. Farm managers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for chronic obstructive pulmonary disease and allied conditions, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 139

Table 2-76. Landscape and horticultural workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for chronic obstructive pulmonary disease and allied conditions, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 140

Table 2-77. Forestry workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for chronic obstructive pulmonary disease and allied conditions, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 141

Table 2-78. Fishery workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for chronic obstructive pulmonary disease and allied conditions, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 142

Figure 2-55. Bronchitis, not specified as acute or chronic: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . 143

Figure 2-56. Chronic bronchitis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 144

Figure 2-57. Emphysema: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 145

Figure 2-58. Asthma: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 146

Figure 2-59. Bronchiectasis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 147

Figure 2-60. Hypersensitivity pneumonitis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 148

Figure 2-61. Chronic airway obstruction, not elsewhere classified: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 149

**Pneumoconiosis and Other Lung Disease Mortality within and by Agricultural Group**

Table 2-79. Crop farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumoconiosis and other lung diseases—external agents, U.S. residents age 15 and over, selected states, 1988–1998 . . . . . 150

## List of Tables and Figures

---

Table 2-80. Livestock farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumoconiosis and other lung diseases—external agents, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	151
Table 2-81. Farm managers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumoconiosis and other lung diseases—external agents, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	152
Table 2-82. Landscape and horticultural workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumoconiosis and other lung diseases—external agents, U.S. residents age 15 and over, selected states . . . . .	153
Table 2-83. Forestry workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumoconiosis and other lung diseases—external agents, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	154
Table 2-84. Fishery workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for pneumoconiosis and other lung diseases—external agents, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	155
Figure 2-62. Coal workers’ pneumoconiosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	156
Figure 2-63. Asbestosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	157
Figure 2-64. Pneumoconiosis due to other silica or silicates: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	158
Figure 2-65. Pneumoconiosis, unspecified: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	159
Figure 2-66. Pneumonitis due to solids and liquids: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	160
Figure 2-67. Respiratory conditions due to other and unspecified external agents: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	161

### **Other Diseases of Respiratory System Mortality within and by Agricultural Group**

Table 2-85. Crop farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of respiratory system, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	162
Table 2-86. Livestock farm workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of respiratory system, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	163
Table 2-87. Farm managers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of respiratory system, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	164
Table 2-88. Landscape and horticultural workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of respiratory system, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	165



---

Table 2-89. Forestry workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of respiratory system, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	166
Table 2-90. Fishery workers: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity for other diseases of respiratory system, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	167
Figure 2-68. Empyema: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	168
Figure 2-69. Pleurisy: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	169
Figure 2-70. Pneumothorax: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	170
Figure 2-71. Abscess of lung and mediastinum: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	171
Figure 2-72. Pulmonary congestion and hypostasis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	172
Figure 2-73. Postinflammatory pulmonary fibrosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	173
Figure 2-74. Other alveolar and parietoalveolar pneumonopathy: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	174
Figure 2-75. Other diseases of the lung: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	175
Figure 2-76. Other diseases of respiratory system: Proportionate mortality ratio (PMR) adjusted for age, sex, and race/ethnicity by agricultural group, U.S. residents age 15 and over, selected states, 1988–1998 . . . . .	176

## **Morbidity**

### **Morbidity by Agricultural Group within Respiratory Condition–NHIS**

Table 3-1. Hayfever (past year): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group and survey year, U.S. residents age 18 and over, 1997–1999 . . . . .	179
Table 3-2. Sinusitis (past year): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group and survey year, U.S. residents age 18 and over, 1997–1999 . . . . .	180
Table 3-3. Chronic bronchitis (past year): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group and survey year, U.S. residents age 18 and over, 1997–1999 . . . . .	181
Table 3-4. Emphysema (ever): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group and survey year, U.S. residents age 18 and over, 1997–1999 . . . . .	182

## List of Tables and Figures

---

Table 3-5. Asthma (ever): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group and survey year, U.S. residents age 18 and over, 1997–1999 .....	183
Table 3-6. Lung cancer (ever): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group and survey year, U.S. residents age 18 and over, 1997–1999 .....	184
Figure 3-1. Respiratory conditions: Prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 18 and over, 1997–1999 .....	185

### **Morbidity by Respiratory Condition and Sex within Agricultural Group–NHIS**

Figure 3-2. Farm workers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by respiratory condition and sex, U.S. residents age 18 and over, 1997–1999 .....	186
Figure 3-3. Farm managers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by respiratory condition and sex, U.S. residents age 18 and over, 1997–1999 .....	187
Figure 3-4. Forestry/fishery workers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by respiratory condition and sex, U.S. residents age 18 and over, 1997–1999 .....	188

### **Morbidity by Respiratory Condition and Race/Ethnicity within Agricultural Group–NHIS**

Figure 3-5. Farm workers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by respiratory condition and race/ethnicity, U.S. residents age 18 and over, 1997–1999 .....	189
Figure 3-6. Farm managers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by respiratory condition and race/ethnicity, U.S. residents age 18 and over, 1997–1999 .....	190
Figure 3-7. Forestry/fishery workers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by respiratory condition and race/ethnicity, U.S. residents age 18 and over, 1997–1999 .....	191

### **Morbidity by Respiratory Condition and Smoking Status within Agricultural Group–NHIS**

Figure 3-8. Farm workers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by respiratory condition and smoking status, U.S. residents age 18 and over, 1997–1999 .....	192
Figure 3-9. Farm managers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by respiratory condition and smoking status, U.S. residents age 18 and over, 1997–1999 .....	193
Figure 3-10. Forestry/fishery workers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by respiratory condition and smoking status, U.S. residents age 18 and over, 1997–1999 .....	194

### **Morbidity by Agricultural Group within Respiratory Condition–NHANES III**

Table 3-7. Wheezing, apart from a cold (current): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 .....	195
Table 3-8. Cough (current): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 .....	196
Table 3-9. Phlegm (current): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 .....	197

Table 3-10. Shortness of breath (current): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . 198

Table 3-11. Stuffy, itchy, runny nose (past year): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994. . . . . 199

Table 3-12. Cold or flu (past year): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . 200

Table 3-13. Sinusitis (past year): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . . 201

Table 3-14. Pneumonia (past year): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . 202

Table 3-15. Wheezing (past year): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . 203

Table 3-16. Asthma (ever): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . . 204

Table 3-17. Chronic bronchitis (ever): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . 205

Table 3-18. Emphysema (ever): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . . 206

Table 3-19. Hayfever (ever): Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . . 207

Figure 3-11. Respiratory conditions (current): Prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994. . . . . 208

Figure 3-12. Respiratory conditions (past year): Prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . . 209

Figure 3-13. Respiratory conditions (ever): Prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994. . . . . 210

**Morbidity by Sex within Respiratory Condition and Agricultural Group–NHANES III**

Figure 3-14. Respiratory conditions (current), farm workers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by sex, U.S. residents age 17 and over, 1988–1994 . . . . . 211

Figure 3-15. Respiratory conditions (current), farm managers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by sex, U.S. residents age 17 and over, 1988–1994 . . . . . 212

Figure 3-16. Respiratory conditions (current), other agricultural workers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by sex, U.S. residents age 17 and over, 1988–1994 . . . . . 213

Figure 3-17. Respiratory conditions (past year), farm workers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by sex, U.S. residents age 17 and over, 1988–1994 . . . . . 214

Figure 3-18. Respiratory conditions (past year), farm managers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by sex, U.S. residents age 17 and over, 1988–1994 . . . . . 215

## List of Tables and Figures

---

- Figure 3-19. Respiratory conditions (past year), other agricultural workers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by sex, U.S. residents age 17 and over, 1988–1994. . . . . 216
- Figure 3-20. Respiratory conditions (ever), farm workers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by sex, U.S. residents age 17 and over, 1988–1994 . . . . . 217
- Figure 3-21. Respiratory conditions (ever), farm managers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by sex, U.S. residents age 17 and over, 1988–1994 . . . . . 218
- Figure 3-22. Respiratory conditions (ever), other agricultural workers: Prevalence ratio (PR) adjusted for age, race/ethnicity, and smoking status by sex, U.S. residents age 17 and over, 1988–1994 . . . . . 219

### **Morbidity by Race/Ethnicity within Respiratory Condition and Agricultural Group—NHANES III**

- Figure 3-23. Respiratory conditions (current), farm workers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 220
- Figure 3-24. Respiratory conditions (current), farm managers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 221
- Figure 3-25. Respiratory conditions (current), other agricultural workers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 222
- Figure 3-26. Respiratory conditions (past year), farm workers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 223
- Figure 3-27. Respiratory conditions (past year), farm managers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 224
- Figure 3-28. Respiratory conditions (past year), other agricultural workers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 225
- Figure 3-29. Respiratory conditions (ever), farm workers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 226
- Figure 3-30. Respiratory conditions (ever), farm managers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 227
- Figure 3-31. Respiratory conditions (ever), other agricultural workers: Prevalence ratio (PR) adjusted for age, sex, and smoking status by race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 228

### **Morbidity by Smoking Status within Respiratory Condition and Agricultural Group—NHANES III**

- Figure 3-32. Respiratory conditions (current), farm workers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 229
- Figure 3-33. Respiratory conditions (current), farm managers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 230
- Figure 3-34. Respiratory conditions (current), other agricultural workers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 231
- Figure 3-35. Respiratory conditions (past year), farm workers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 232

Figure 3-36. Respiratory conditions (past year), farm managers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 233

Figure 3-37. Respiratory conditions (past year), other agricultural workers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 234

Figure 3-38. Respiratory conditions (ever), farm workers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 235

Figure 3-39. Respiratory conditions (ever), farm managers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 236

Figure 3-40. Respiratory conditions (ever), other agricultural workers: Prevalence ratio (PR) adjusted for age, sex, and race/ethnicity by smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 237

**Morbidity by Agricultural Group within Spirometry Index: FEV<sub>1</sub>, FVC, PEF–NHANES III**

Table 3-20. Spirometry: Forced expiratory volume in one second (FEV<sub>1</sub>), forced vital capacity (FVC), and peak expiratory flow (PEF) by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . . 238

Table 3-21. Spirometry: Percent predicted forced expiratory volume in one second (FEV<sub>1</sub>), forced vital capacity (FVC), and peak expiratory flow (PEF) by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . . 239

Table 3-22a. Obstructive abnormality: Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . 240

Table 3-22b. Restrictive abnormality: Estimated prevalence and prevalence ratio (PR) adjusted for age, sex, race/ethnicity, and smoking status by agricultural group, U.S. residents age 17 and over, 1988–1994 . . . . 240

**Morbidity by Agricultural Group and Sex within Spirometry Index: FEV<sub>1</sub>, FVC, PEF–NHANES III**

Figure 3-41. Percent predicted forced expiratory volume in one second (FEV<sub>1</sub>) by agricultural group and sex, U.S. residents age 17 and over, 1988–1994 . . . . . 241

Figure 3-42. Percent predicted forced vital capacity (FVC) by agricultural group and sex, U.S. residents age 17 and over, 1988–1994 . . . . . 242

Figure 3-43. Percent predicted peak expiratory flow (PEF) by agricultural group and sex, U.S. residents age 17 and over, 1988–1994 . . . . . 243

**Morbidity by Agricultural Group and Race/Ethnicity within Spirometry Index: FEV<sub>1</sub>, FVC, PEF–NHANES III**

Figure 3-44. Percent predicted forced expiratory volume in one second (FEV<sub>1</sub>) by agricultural group and race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 244

Figure 3-45. Percent predicted forced vital capacity (FVC) by agricultural group and race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 245

Figure 3-46. Percent predicted peak expiratory flow (PEF) by agricultural group and race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 246

## List of Tables and Figures

---

### **Morbidity by Agricultural Group and Smoking Status within Spirometry Index: FEV<sub>1</sub>, FVC, PEF–NHANES III**

- Figure 3-47. Percent predicted forced expiratory volume in one second (FEV<sub>1</sub>) by agricultural group and smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 247
- Figure 3-48. Percent predicted forced vital capacity (FVC) by agricultural group and smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 248
- Figure 3-49. Percent predicted peak expiratory flow (PEF) by agricultural group and smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 249

### **Morbidity by Agricultural Group and Sex within Spirometry Index: Obstructive and Restrictive Abnormality–NHANES III**

- Figure 3-50. Spirometry: Percent of workers with obstructive abnormality by agricultural group and sex, U.S. residents age 17 and over, 1988–1994 . . . . . 250
- Figure 3-51. Spirometry: Percent of workers with restrictive abnormality by agricultural group and sex, U.S. residents age 17 and over, 1988–1994 . . . . . 251

### **Morbidity by Agricultural Group and Race/Ethnicity within Spirometry Index: Obstructive and Restrictive Abnormality–NHANES III**

- Figure 3-52. Spirometry: Percent of workers with obstructive abnormality by agricultural group and race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 252
- Figure 3-53. Spirometry: Percent of workers with restrictive abnormality by agricultural group and race/ethnicity, U.S. residents age 17 and over, 1988–1994 . . . . . 253

### **Morbidity by Agricultural Group and Smoking Status within Spirometry Index: Obstructive and Restrictive Abnormality–NHANES III**

- Figure 3-54. Spirometry: Percent of workers with obstructive abnormality by agricultural group and smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 254
- Figure 3-55. Spirometry: Percent of workers with restrictive abnormality by agricultural group and smoking status, U.S. residents age 17 and over, 1988–1994 . . . . . 255

### **Morbidity by Agricultural Group within Dust Diseases of the Lung and Respiratory Conditions Due to Toxic Agents–SOII**

- Table 3-23. Dust diseases of the lung: Estimated incidence per 10,000 workers by agricultural group, 1995–2001 . . . . . 256
- Table 3-24. Respiratory conditions due to toxic agents: Estimated incidence per 10,000 workers by agricultural group, 1995–2001 . . . . . 257

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# **Highlights and Limitations**

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## Highlights

*These selected highlights summarize the major findings in the report, including a description of results that were statistically elevated. Mortality statistics were derived from deaths from 24 states for 1988–1998, while morbidity data came from two large population-based surveys of the U.S. undertaken in 1997–1999 and 1988–1994.*

- Decedents whose death certificate indicated that they worked as *crop workers* had significantly elevated mortality for a number of respiratory conditions, including hypersensitivity pneumonitis (proportionate mortality more than 10 times higher than expected), asthma, bronchitis, histoplasmosis, tuberculosis, pneumonia, and influenza. (Tables H-1 and H-2)
- Decedents whose death certificate indicated that they worked as *livestock farm workers* had significantly elevated mortality for several respiratory conditions, including hypersensitivity pneumonitis (proportionate mortality more than 50 times higher than expected), asthma, tuberculosis, and influenza. (Tables H-1 and H-2)
- Decedents whose death certificate indicated that they worked as *landscape or horticultural workers* had significantly elevated mortality for chronic obstructive pulmonary diseases (COPD), including chronic airways obstruction, and for abscesses of the lung and mediastinum. (Tables H-1 and H-2)
- Decedents whose death certificate indicated that they worked as *forestry workers* had significantly elevated mortality for tuberculosis, COPD, including chronic airways obstruction, and for pneumonia. (Tables H-1 and H-2)
- Decedents whose death certificate indicated that they worked as *fishery workers* had significantly elevated mortality for COPD, including chronic airways obstruction. (Tables H-1 and H-2)
- At least two of the agricultural groups studied in this report were noted to have significantly elevated mortality for several respiratory diseases, including tuberculosis, hypersensitivity pneumonitis, asthma, COPD, pneumonia, and influenza. Significantly elevated COPD mortality was noted in three agricultural groups (*landscape and horticultural workers, forestry workers, and fishery workers*). (Table H-2)
- Individuals who reported that their longest job held was *farm worker* had elevated prevalence of phlegm production compared to all non-agricultural workers. Prevalence of wheeze was elevated for female *farm workers* and shortness of breath was elevated for *farm workers* who had ‘ever smoked.’ (Table H-3)
- *Farm workers* had a prevalence ratio (PR) of 173 for obstructive abnormality. (Table 3-22a)

## Highlights

**Table H-1. Mortality: Significantly elevated proportionate mortality ratios (PMRs) by agricultural group**

Disease (ICD-9 Code)	Number of Deaths	PMR	For more detail see:	
			Table	Figure
<b>Crop Farm Workers</b>				
Hypersensitivity pneumonitis (495)	23	1,228	2-73	2-60
Blastomycotic infection (116)	14	245	2-43	2-39
Histoplasmosis (115)	27	183	2-43	2-38
Bronchitis, not specified as acute or chronic (490)	269	134	2-73	2-55
Abscess of lung and mediastinum (513)	153	120	2-85	2-71
Pulmonary congestion & hypostasis (514)	1,830	113	2-85	2-72
Asthma (493)	813	111	2-73	2-58
<b>Tuberculosis (010–018)</b>				
Miliary tuberculosis (018)	35	196	2-37	2-36
Pulmonary tuberculosis (011)	437	152	2-37	7-31
<b>Acute respiratory infections (460–466)</b>				
Acute upper respiratory infections of multiple or unspecified sites (465)	87	160	2-55	2-44
Acute bronchitis and bronchiolitis (466)	126	117	2-55	2-45
<b>Pneumonia and influenza (480–487)</b>				
Influenza (487)	232	142	2-67	2-54
Other bacterial pneumonia (482)	955	120	2-67	2-50
Pneumonia, organism unspecified (486)	23,135	109	2-67	2-53
<b>Livestock Farm Workers</b>				
Hypersensitivity pneumonitis (495)	31	5,563	2-74	2-60
Other respiratory tuberculosis (012)	5	675	2-38	2-32
Tuberculosis of meninges and central nervous system (013)	5	546	2-38	2-33
Asthma (493)	276	150	2-74	2-58
Influenza (487)	73	150	2-68	2-54
<b>Landscape and Horticulture Workers</b>				
Abscess of lung and mediastinum (513)	13	190	2-88	2-71
Chronic obstructive pulmonary disease and allied conditions (COPD) (490–496)	799	109	2-4	2-8
Chronic airway obstruction, nec (496)	624	111	2-76	2-61
<b>Forestry Workers</b>				
Pulmonary tuberculosis (011)	41	143	2-41	2-31
Chronic obstructive pulmonary disease and allied conditions (COPD) (490–496)	2,318	122	2-5	2-8
Chronic airway obstruction, nec (496)	1,890	127	2-77	2-61
Pneumonia and influenza (480–487)	1,771	116	2-5	2-7
Pneumonia, organism unspecified (486)	1,564	117	2-71	2-53
<b>Fishery Workers</b>				
Chronic obstructive pulmonary disease and allied conditions (COPD) (490–496)	568	113	2-6	2-8
Chronic airway obstruction, nec (496)	455	116	2-78	2-61

nec - not elsewhere classified ICD - International Classification of Diseases

NOTE: PMRs are adjusted for age, sex, and race, U.S. residents age 15 and over, selected states (see Appendix D), 1988–1998. PMRs are significantly different from 100 ( $p < 0.05$ ).

SOURCE: National Center for Health Statistics multiple-cause-of-death data

**Table H-2. Mortality: Disease and disease categories with significantly elevated proportionate mortality ratios (PMRs) in two or more agricultural groups**

Disease (ICD-9 Code)	Crop Farm Workers	Livestock Farm Workers	Landscape and Horticulture Workers	Forestry Workers	Fishery Workers
Pulmonary tuberculosis (011)	✓			✓	
Abscess of lung and mediastinum (513)	✓		✓		
Pneumonia/influenza (480–487)	✓			✓	
Pneumonia, organism unspecified (486)	✓			✓	
Influenza (487)	✓	✓			
Chronic obstructive pulmonary disease (490–496)				✓	✓
Asthma (493)	✓	✓			
Hypersensitivity pneumonitis (495)	✓	✓			
Chronic airway obstruction, nec (496)			✓	✓	✓

nec - not elsewhere classified

NOTE: *Crop farm workers* had 10, *livestock farm workers* had 2, and *landscape and horticultural workers* had 1 other respiratory diseases or disease categories with significantly elevated PMRs. See Table H-1. PMRs are adjusted for age, sex, and race, U.S. residents age 15 and over, selected states (see Appendix D), 1988–1998. PMRs are significantly different from 100 ( $p < 0.05$ ).

SOURCE: National Center for Health Statistics multiple-cause-of-death data

**Table H-3. Morbidity: Significantly elevated prevalence ratios (PRs) by agricultural group**

Respiratory Condition	PR	<i>For more details see:</i>	
		Table	Figure
Farm Workers			
Phlegm (current)	133	3-9	3-11
Females	226		3-14
Ever smoked	156		3-32
Wheezing (apart from a cold), females	155		3-20
Wheezing (past year), females	146		3-17
Shortness of breath (current), ever smoked	130		3-32

NOTE: PRs are adjusted for age, sex, race, and smoking (except for smoking-specific analyses), U.S. residents age 17 and over, 1988–1994. PRs are significantly different from 100 ( $p < 0.05$ ).

SOURCE: National Center for Health Statistics, Third National Health and Nutrition Examination Survey (NHANES III)



## Limitations

*In addition to the following cautions, readers should see Appendix A for other limitations relating to specific sources of data presented in this report.*

### General

- In this report, the data are drawn from the major existing databases. However, other data may exist that would improve the completeness and reliability of the findings presented in this report. Readers who are aware of other data that should be considered for inclusion in future editions are encouraged to make their suggestions known (see Preface for contact information).

- Statistics in many tables and figures in this report are based on small numbers. Readers are cautioned that these can be unstable. Hence, inferences should be drawn with care, and should take the numerical basis into account.

- A decedent's or survey respondent's usual or current industry/occupation is not always indicative of the industry and occupation associated with the exposure that may be responsible for that individual's disease even when that disease is work-related. Readers are therefore cautioned not to make definitive causative inferences about industries and occupations based solely on the various mortality and morbidity tables and figures presented in this report.

### Mortality Data

- Data from only 24 states were used in the mortality analysis since reliable information on industry and occupation was not available for every state. These 24 states collectively account for 32 percent of the U.S. agricultural worker population (Table 1-2); they do not include the three states having the most agricultural employment (California, Texas, and Florida). Although the information presented is believed to be reasonably representative of health outcomes among all agricultural workers, it may not provide a fully accurate picture.

- Individuals affected by chronic diseases with long latency have much more time to change residences prior to death than individuals affected by acute diseases with short latency. Thus, state of residence at death does not necessarily represent the location of a decedent's occupational exposure, even for a death that results directly from occupational respiratory disease. However, unlike many other occupations, farmers often continue to work well beyond 65 years of age and 18% of the U.S. farm operators are over age 65<sup>1</sup>, indicating that farmers are less likely to change residences before death than other occupation.

- Work-related respiratory diseases are often chronic, may also have long latencies, but often may not be reported as the underlying cause of death. This led to a decision to consider both underlying and contributing causes of death in the mortality summary tables and figures in this report.

- Certifying physicians typically do not list all of a decedent's diseases on the death certificate. Therefore, even though contributing causes of death are considered, the mortality data presented in this report probably underestimate the occurrence of some or most respiratory diseases.

- As with any analysis based on death certificate data, there is undoubtedly some misclassification of cause of death. A treating physician may not correctly diagnose a particular disease during a patient's life or, as mentioned above, a certifying physician may fail to list a correctly diagnosed disease on the death certificate, particularly if another disease was directly responsible for the individual's death. In addition, the diagnoses listed on the death certificate sometimes are miscoded.

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<sup>1</sup>U.S. Department of Commerce [1992]. Census of Agriculture. Washington, DC: U.S. Government Printing Office.

## *Limitations*

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- Data that depend, either directly or indirectly, on physician reporting or recording of occupational disease diagnoses can be influenced significantly by the physician's ability or willingness to suspect and evaluate a relationship between work and health. These, in turn, are influenced by evolving medical and scientific information, and by the legal, political and social environment. Some factors may lead to increased diagnosis and recording and reporting whereas others may reduce occupational disease recognition or reporting by physicians.

- The PMRs in this report have not been adjusted for smoking or any other confounding exposure because of lack of these data. Note that PMRs are vulnerable to difficulties in interpretation in that an elevated PMR may reflect an excess in a particular disease mortality or may simply arise from deficits in mortality from other diseases. The PMRs in this report are derived from data reported by only 24 states and omit data from some of the major agricultural states (e.g., California). They therefore may not be representative of the mortality patterns for the whole country. In addition, they may fail to indicate risks for some agricultural operations and situations not, or poorly, represented in the 24 states.

### **Morbidity Data**

- Data from both the NHIS and NHANES surveys are restricted to a sample of household-based respondents in the U.S. A typical round of NHIS or NHANES has about 30,000 respondents. Although weights reflecting the probability of selection for each survey respondent are provided (and were used in the analysis) to enable national estimates, the actual number of respondents is especially small when the data are disaggregated into groups (e.g., agricultural workers). For certain conditions such as emphysema and lung cancer, the numbers are especially small. Hence, the cautions given above for mortality data, against making broad inferences or generalizations from the data

provided in this report, apply even more strongly here. In the case of the NHIS data, an attempt was made to compensate for small numbers by summing estimates from the most recent three years (1997–1999) for which survey data were available at the time of the analysis.

- Some of the conditions about which respondents were asked in these surveys relate to the individual's lifetime (e.g., has a doctor ever told you that you have asthma?), whereas others relate to a more recent period (e.g., during the past 12 months, have you had pneumonia?). Hence, the relationship between work and health may be conditional on the time frame of reference for the question, the individual's age, and whether the industry/occupation codes used in the analysis relate to the respondent's current or usual industry/occupation. For the NHANES data, the industry/occupation in which the respondent worked longest was used in the analysis, whereas for the NHIS data only the current industry/occupation was asked of the respondent.

- The questions asked about conditions in the NHANES and NHIS surveys are sensitive to the respondent's ability to recognize such conditions and to correctly answer the questions. Thus, there are potential reporting biases that may be associated, for example, with respondent age or socioeconomic status. The spirometric data from NHANES do not share this limitation, as they are objective measures of respiratory health derived from lung function tests.

- The method used to calculate confidence intervals for prevalence ratios assumes an underlying Poisson distribution and is strictly applicable to outcomes that are rare. Some of the outcomes reported in the survey (e.g., asthma) are not rare, and as a consequence the reported confidence intervals should be regarded as approximate.

- Unlike the NHIS and NHANES data, public-use data files were not available for the BLS injury and illness data. Only incidence rates summarized by industry for *dust diseases of the lung* and *respiratory conditions due to toxic agents* are publicly available, and it was not possible to adjust the survey results for factors such as age, sex, race/ethnicity, or smoking status. In the BLS data, work-related diseases are generally under-recognized and under-reported by employers. (Note: BLS confidential microdata for non-fatal injuries and illnesses is available for research, but users may access this data only at the BLS national office in Washington, D.C.)
- The agricultural occupation and industry coding systems for the source data employed in the presentation of the demographic, morbidity, and mortality data are broadly similar but differ in detail, preventing exact comparisons between them. See Appendices E, F, and G for descriptions of the industry and occupation codes relevant to this report.

