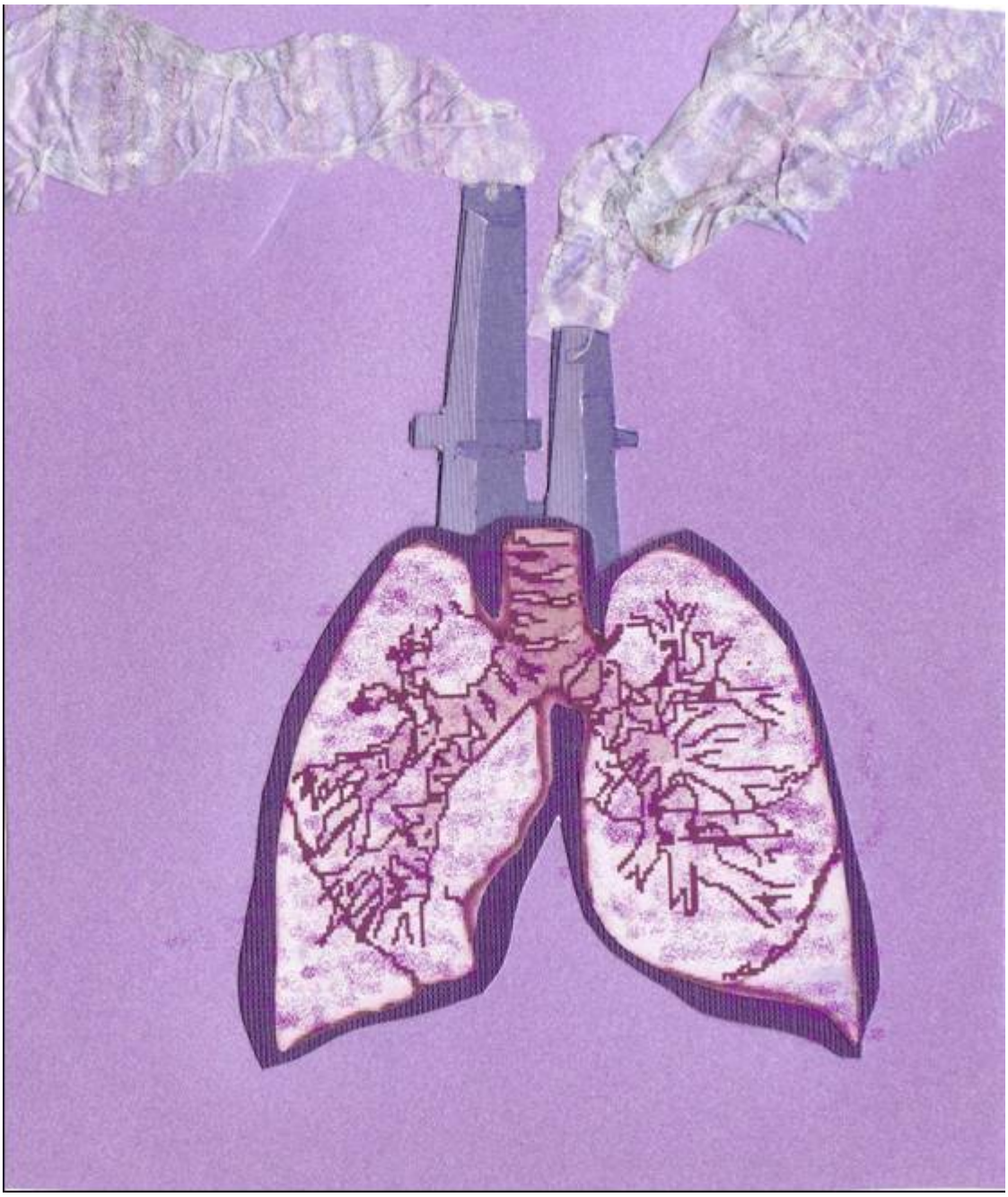

Work-Related Asthma in Wisconsin

Occupational Health Surveillance Program
Bureau of Environmental and Occupational Health

List of Abbreviations and Acronyms

BLS	Bureau of Labor Statistics
CDC	Centers for Disease Control and Prevention
CSTE	Council of State and Territorial Epidemiologists
DHS	Department of Health Services
ED	Emergency Department
FACE	Fatality Assessment and Control Evaluation
HD	Hospital Discharge
ICD-9	International Classification of Diseases, 9th Revision
NAICS	North American Industry Classification
NIOSH	National Institute for Occupational Safety & Health
OA	Occupational Asthma
OHS	Occupational Health Surveillance
OSHA	Occupational Safety and Health Administration
SIC	Standard Industrial Classification
SOC	Standard Occupational Classification
WAA	Work-aggravated Asthma
WC	Workers' Compensation
WRA	Work-related Asthma

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Summary

Each year the Wisconsin Occupational Health Surveillance (OHS) Program releases a report to increase awareness of hazards in Wisconsin workplaces. Last year's report focused on the indicators of occupational health collected through surveillance activities. This year the focus is on one specific occupational health illness - work-related asthma (WRA).

Data for this report were obtained from four sources: workers' compensation claims; hospital discharge records; emergency department visit records; and death records. Data ranged from 1999 through 2006, depending on the data source. Additional data used include surveys and research conducted in Wisconsin and other states during various timeframes.

A consensus statement from the American Thoracic Society concluded: "*The median value of 15% is a reasonable estimate of the occupational contribution to the population burden of asthma.*" However, confirming this finding through state-based surveillance data has been difficult. Recently the Wisconsin OHS Program has used available data sources to investigate the prevalence and characteristics of WRA in the state. A Wisconsin BRFSS survey conducted in 2006 found 11% of Wisconsin residents with asthma reported that they had been told by a doctor or health professional that their asthma was related to either a current job or to one they held in the past. Using those findings, as many as 71,000 Wisconsin residents may have work-related asthma.

There are different types of WRA. Workplace exposures may cause onset of new asthma from exposure to an allergen or an irritant that precipitates inflammatory changes, or they may exacerbate pre-existing asthma. Almost eighty percent of the workers' compensation claims for asthma involve the new-onset asthma. Over 300 agents or work processes have been associated with WRA. Nationwide, indoor air pollutants, dusts, cleaning materials, lubricants and diisocynates are among the most frequently reported causes of WRA (Jajosky, 1999, CDC/NIOSH, 2008). In Wisconsin, dust, smoke, fumes, chemicals, and vapors are often cited as making breathing difficult at work. While exposures to allergens contributing to asthma exacerbations are occurring in a wide range of workplaces, air monitoring at these same facilities typically reveal that exposure to the suspected allergen or irritant is within existing workplace standards approximately 95% of the time, however, significant numbers of symptomatic individuals can be identified (Rosenman, 2006).

According to the Wisconsin data examined, WRA affects both men and women. While it most frequently affects those from the ages of 35-45 years, WRA has been reported in workers as young as 12 years of age and as old as 66 years of age. Most workers who report having WRA are Caucasian; however, when looking at the rate of this illness (the proportion of those affected to the number of workers), African-American workers are affected over twice as often as Caucasian workers.

In order to create awareness and prevent workplace exposures that can cause or exacerbate asthma, Wisconsin has implemented a series of mini-grants for work-related asthma research and interventions. Five projects will be completed by the end of June 2009. These include raising physician awareness of WRA; developing standard diagnosis criteria; raising employer and employee awareness of WRA; advocating for smoke-free workplaces, and researching bio-aerosol allergens in the dairy industry.

Conclusions

- The work-related asthma (WRA) burden contributes approximately 11% to the overall asthma burden in Wisconsin
- There are two types of WRA – new-onset asthma and work-aggravated asthma
- African-American workers have a higher rate of WRA than Caucasians
- Indoor air quality is frequently cited as a cause of WRA in Wisconsin

Introduction

Data collected in the 2006 Behavior al Risk Factor Surveillance Survey (BRFSS) show that 13% of Wisconsin adults report ha ving asthma at sometime during their life. Asthma is a chronic l ung disease characterized by ongoing airway inflammation that can result in episodic events of wheezing, shortness of breath, coughing and chest tightness. Individuals with asthma have increased airway reactivity often in response to stimuli such as environmental allergens and irritants, viral infections and cold air.

Asthma is identified as a stat ewide health st atus priority in the Wis consin public health plan, *Healthiest Wisconsin 2010* (available at http://dhs.wisconsin.gov/statehealthplan/). The Wisconsin Department of Health Services (D HS) seeks to comprehensively address the burden of asthma, including work-related asthma, through sur veillance, partnerships and int erventions. To do so the *Wisconsin Asthma Plan* (available at http:// dhs.wisconsin.gov/eh/Asthma/WAP.htm) was developed as a blueprint for addressing this public health priority.

Work-related asthma is a common occupational respiratory disease in al l industrialized countries. (CDC/NIOSH, 2004). Irritants and allergens in the workplace can cause asth ma or make existing asthma worse. Nationwide it is estimated that work-related asthma (WRA) accounts for at least 10 % of all adult asthma.(Youakim, 2001)

Types of work-related asthma

Asthma related to the workplace is generally categorized into two subsets: ***work aggravated asthma*** and ***new-onset asthma***.

Work-aggravated asthma

Persons with *work-aggravated asthma* have a history of preexisting asth ma. Asthmatic episodes can be triggered in the workplace by stressors such as allergens, dusts, abnorm al temperatures, poor i ndoor air quality, and physically strenuous work or chem icals. A study of the prevalenc e of work-ag gravated symptoms in clinically established asthma c ases in Finland found that the prevalence of work-aggravated asthma is common among employed adults with asthma and that the prevalence increases with age (Saarinen, 2003). A study in of work-aggravated asth ma the United State s found that th e risk of wo rk-aggravated asthma was the highest in industries classified as public administration (Goe, 2004; Henneberger, 2007).

New-onset asthma

New-onset asthma develops as a direct result of some wor kplace exposure. Two forms of new-onset asthma generally are recognized - reactive airway dysfunction syndrome (RADS) and allergic occupational asthma (OA).

RADS usually develo ps after a single hi gh dose of an ir ritant chemical, often the result of an accident, spill or equipment failure. In RADS, workers usually develop asthma symptoms, such as diffi culty breathing, and wheezing, within 24 hours of an exposure event such as an unscheduled chemical release. The Department of Health Services' Hazardous Substance Emergency Events Surveillance (HSEES) program tracks these events. As an example, a summary of a 15-y ear period of ammonia release in Wis consin including the counties in which they occurred is included in this report.

Occupational asthma is a result of repeated exposure to an agent in the workplace. With repeated exposure a worker becomes sensitized or allergic to that substance. Eventually exposure will m anifest as broncho-spasm s and airway inflammation. The time it takes t o develop symptoms can b e as short a s several weeks or as long as 30 years. Table 3 lists known allergens and indu stries where they are found. There are over 3 00 allergens found in the workplace. A co mprehensive list can be found on the Asmapro website at http://www.asmanet.com/asmapro/accueil-cd.html. An abbreviated listing was compiled by New Jersey and can be accessed at: http://nj.gov/health/eoh/survweb/wra/documents/asthmagens.pdf.

Type and Sub-type of work-related asthma

Type	Sub-Type	Key Elements
Work-aggravated	None	▪ Previous asthma diagnosis ▪ Recurrent episodes ▪ Triggered by workplace
New-onset	Reactive airway dysfunction syndrome (RADS)	▪ Single high-dose exposure ▪ Symptoms occur within 24 hours of exposure ▪ Direct lung irritation
	Occupational asthma	▪ Repeated sensitizing exposure ▪ Symptoms develop after a variable latent period ▪ Allergic reaction causes lung dysfunction

Agents of Reactive Airways Dysfunction Syndrome (RADS)

Agent	Industry
2-diethylaminoethanolamine	Plastics manufacturing
Acetic acid	Dairy and food manufacturing
Anhydrous ammonia	Refrigeration manufacturing and repair
Bleaching agents	Building maintenance (cleaning), painting, adhesive use and manufacturing
Burned paint fumes	Cleaning and restoration, fire fighters
Chlorine gas	Cleaning, water treatment
Floor sealant	Maintenance, construction
Hydrochloric acid	Battery manufacture and installation, paper manufacture
Hydrogen sulfide	Agriculture, maintenance
Automotive or diesel exhaust	Auto repair
Phosgene	Plastic production, pesticide manufacture and application, maintenance
Phosphoric acid	Fertilizer, detergent, flooring, food and pharmaceutical production
Silicon	Glass, concrete and cement manufacture and grinding
Silo gas	Agriculture
Smoke (inhaled)	Fire protection, hospitality
Sodium hydroxide	Paper, textile and detergent manufacture, maintenance, water treatment
Sulfuric acid	Chemical manufacturing, ore processing, wastewater treatment
Toluene diisocyanate	Polyurethane product manufacture, maintenance
Welding fumes (NO, CO, MNO_2)	Welding
Zinc chloride	Textile and chemical manufacturing, welding

Occupational Asthma Allergens and Occupations Affected

Type of Allergen	Allergen	Occupation
Animal	Urine and other protein	Animal handler, research scientist
	Grain mite	Farmers, grain store workers
	Shellfish	Seafood processors
	Egg protein	Egg production workers
Plant	Grain dust	Grain storage workers
	Flour, wheat, soy or rye	Bakers, millers
	Latex	Healthcare workers
	Green coffee beans	Coffee roasters
	Henna	Hairdressers
	Gum acacia	Printers
Enzymes	Protease from B. *subtilis*	Detergent industry workers
	Pancreatin, papain, pepsin	Pharmaceutical industry workers
	Fungal amylase	Bakers
Wood dusts or bark	Western red cedar, iroko, cinnamon, oak, mahogany, redwood, African apple	Sawmill workers, joiners, carpenters
Drugs	Penicillians, psyllium, cimetidine, salbutamol, intermediates	Pharmaceutical and healthcare workers
Other	Oil mists	Tool setters

HAZARDOUS SUBSTANCES EMERGENCY EVENTS SURVEILLANCE (HSEES)
FIFTEEN-YEAR PERIOD: JANUARY 1, 1993 THROUGH DECEMBER 31, 2007

TOTAL AMMONIA EVENTS

The number of ammonia events meeting the surveillance definition of the HSEES System during this15-year period totaled **719** (12% of total events).

AMMONIA EVENTS WITH VICTIMS

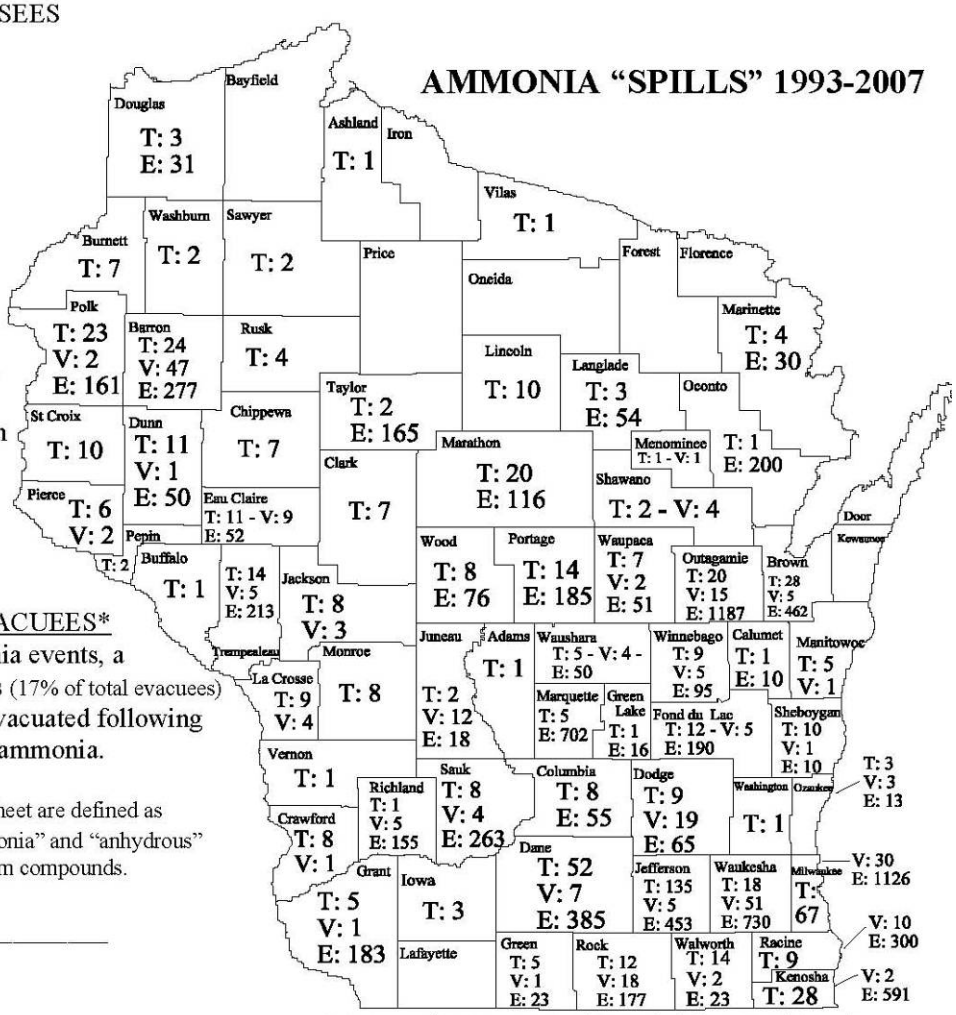
Of the 719 total ammonia events, **102** events resulted in a total of **287** victims (19% of total victims), with each person suffering at least one verifiable injury resulting from exposure to ammonia.

AMMONIA EVENTS WITH EVACUEES*

During **174** of the 719 total ammonia events, a minimum total of **8,943 individuals** (17% of total evacuees) were ordered to evacuate, or self-evacuated following a release (or threatened release) of ammonia.

Note: Total Ammonia Events in this fact sheet are defined as only those including the descriptors "ammonia" and "anhydrous" and do not include, for example, ammonium compounds.

EVENTS, VICTIMS AND EVACUEES*



ABBREVIATION KEY: MAP
- T: TOTAL AMMONIA EVENTS
- V: AMMONIA VICTIMS
- E: AMMONIA EVACUEES
- * (Persons ordered and self-evacuated)

Note: The HSEES system does not include events where only petroleum products have been released

SUMMARY OF **AMMONIA EVENTS** IN WISCONSIN
BY CALENDAR YEAR

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	**Cum. Totals**
EVENTS	54	46	61	53	46	41	38	30	39	74	68	62	55	29	23	**719**
VICTIMS	3	10	7	40	18	12	27	5	13	78	22	11	22	17	2	**287**
EVACUEES	420	294	565	1,039	641	442	1,238	1,060	427	346	173	823	359	332	784	**8,943**

Report prepared by the Division of Public Health, Wisconsin Department of Health and Family Services, with funds from the CERCLA trust fund, and the Office of Terrorism Planning and Emergency Response of the CDC, and provided by the Agency for Toxic Substances and Disease Registry, Public Health Service, US DHHS under Cooperative Agreement Number 5U61/TS574144-4. Contact James Drew, WI HSEES Program Coordinator. Phone: (608) 266-2663. E-mail: drewjm@dhfs.state.wi.us WI HSEES Web Site:http://dhfs.wisconsin.gov/eh/HSEES

PPH 45086 (04/08)

Data Sources

Data and information used in this report came from six data sources – the Behavioral Risk Factor Surveillance Survey (BRFSS), inpatient hospital discharge billing data, emergency department visit billing data, death records, workers' compensation claims data, and national information published in research reports. Use of such administrative datasets has both strengths and limitations. The main strength is their availability. No new data collection is required, and access can be easily obtained. However, administrative data has limitations. In most cases, the primary purpose of assembling such data is not public health surveillance; as such, fields collected for purposes other than billing may be incomplete or not thoroughly checked for accuracy. These data seldom tell the whole story and further analysis is necessary to understand the nature of the problem. Because of these data limitations one must be cautious in their comparison and interpretation. The material that follows includes a more detailed description of the data sources and their use in this report.

Workers' Compensation Data

The Workers' Compensation (WC) program is an insurance program designed to cover medical expenses and lost income of workers who become injured or ill during the course of doing work activities. Claimant disease and injury information is captured in an incident narrative. The Wisconsin Occupational Health Surveillance (OHS) program receives a select subset of these data in order to conduct surveillance for asthma in the workplace. Data examined only claims that have been paid for days away from work. The most meaningful measures for these data are rates of occurrences per number of workers (incidence rate) or per number of hours worked (frequency rate) and the costs associated with injury occurrence.

Strengths of these data include the large number of records in the database, as well as the collection of industry and occupation through standard codes.

Weaknesses include incomplete data. While the collection of industry and occupation is a strength of these data, only 44% of the WC data used in our analysis had complete information. Other weaknesses include underreporting of accidents and illness because of claim suppression and contestation, the omission of events not resulting in missed time at work, and the lack of racial or ethnicity information.

Hospitalization Discharge Data

Wisconsin keeps records of all patients admitted to medical facilities in the state including, acute care and non-federal hospitals, and other institutions such as general medical/surgical, psychiatric, alcohol and other drug abuse (AODA), and rehabilitation facilities. Hospital inpatient discharge records are reported quarterly to the Wisconsin Hospital Association as required by Wisconsin statute and administrative code.

This administrative dataset was developed primarily for billing purposes, but these data have been used by researchers, analysts and planners for a broad range of other purposes as well. Specifications for the data elements reported are based on the Uniform Billing Form (UB-92) and include patient demographic data, admission and discharge data, charge and payer data, and ICD-9 CM-coded diagnostic and procedure information.

Hospital discharge records are extensively checked and edited for quality and completeness, and hospitals are required to verify or correct all invalid codes and missing or inconsistent items. These data, however, have not been audited by comparisons to actual source hospital billing and medical records. To use hospital discharge data effectively, it is necessary to have denominator data for the areas and populations that will be examined. Hospital utilization is generally expressed as a rate (e.g. admissions or discharges per 100,000 area population).

Strengths of use of these data include easy accessibility, timeliness, and completeness, allowing for use of these data repeatedly over time to identify trends.

The weaknesses of this dataset include the inability of comparison to the larger population due to bias of physician interpretation of diagnosis and other variations from hospital to hospital in the quality of medical records coding. Using hospital discharge data as a tool for occupational health surveillance may not capture all relevant cases. This is true for several reasons. First, only the most severe cases are admitted to the hospital for tretment and hospitalizations of Wisconsin residents occurring in other states are not captured in the Wisconsin Hospital Association's database. Additionally, data from the state's three federal VA hospitals in Wisconsin are also excluded. In many cases, patient bills for work-related illness and injury may be paid by private insurance rather than by workers' compensation.

Criteria for Using Hospital Discharge Records

- Payer = Workers' Compensation
- Principal diagnosis (ICD-9) code = 493.0-493.9
- Zipcode = zipcode of Wisconsin residence

Emergency Department Visits

This source of data contains individual-level data for visits to the emergency department of Wisconsin hospitals (general medical-surgical, psychiatric, alcohol and other drug abuse, rehabilitation, and state hospitals). Data elements received include hospital identifiers, diagnosis and procedure codes, expected total charges, the expected payer of those charges, the source and type of admission, and the patient discharge destination. Physician license numbers are not included; however the Physician-Enhanced Emergency Department Dataset links discharge data with physician information.

Use of these electronic datasets is a relatively recent development. Collection and distribution began in 2002. Because of its recent development, some potential problems with data quality persist. For purposes of this report, the ED visit records were used as a measure of prevalence and severity. Although emergency department visit data were used as a surrogate for the severity of exposure or injury, it is difficult to determine the magnitude of the exposure; if multiple workers are exposed in the same workplace and obtain treatment in different facilities and their treatment may not be recognized as a consequence of the same event.

For purposes of WRA surveillance the selection criteria used with ED visit data are the same as hospital discharge selection criteria with workers' compensation listed as the payer. As with all other datasets, analysis of administrative data cannot provide a causal explanation for a high rate. ED data, however, can be of use in the analysis of patterns among population subgroups and geographic areas.

Strengths and weaknesses of this dataset are the same as the hospital discharge data.

Behavioral Risk Factor Surveillance System

The Behavioral Risk Factor Surveillance System (BRFSS) is a random-digit-dialed telephone survey of the US civilian, non-institutionalized population aged 18 years and older with telephones. Survey respondents are randomly selected to ensure that the survey data will be representative of all adults in Wisconsin. Survey data are adjusted or "weighted" by age and sex distribution for Wisconsin's population so that the resulting estimates can be generalized to the state's entire population, not just those who responded to the survey. The BRFSS asks respondents about their health and health behaviors. For work-related asthma, a separate, additional survey, the asthma follow-up survey, is offered for administration to any respondent who claims to have had asthma.

Data for the 2006 follow-up survey were examined and used to provide an estimate of the prevalence of work-related asthma in Wisconsin. The major strengths of the BRFSS include its ease in collecting a large amount of state-specific data. Since the survey has been conducted for more than two decades, there is a wealth of experience in data collection as well as showing trends over time.

Weaknesses include that the exclusion of subjects without home telephones, the self-reported nature of the data, and the inability to link follow-up survey data to original survey results.

2006 BRFSS Asthma Call-Back survey responses for work-relatedness

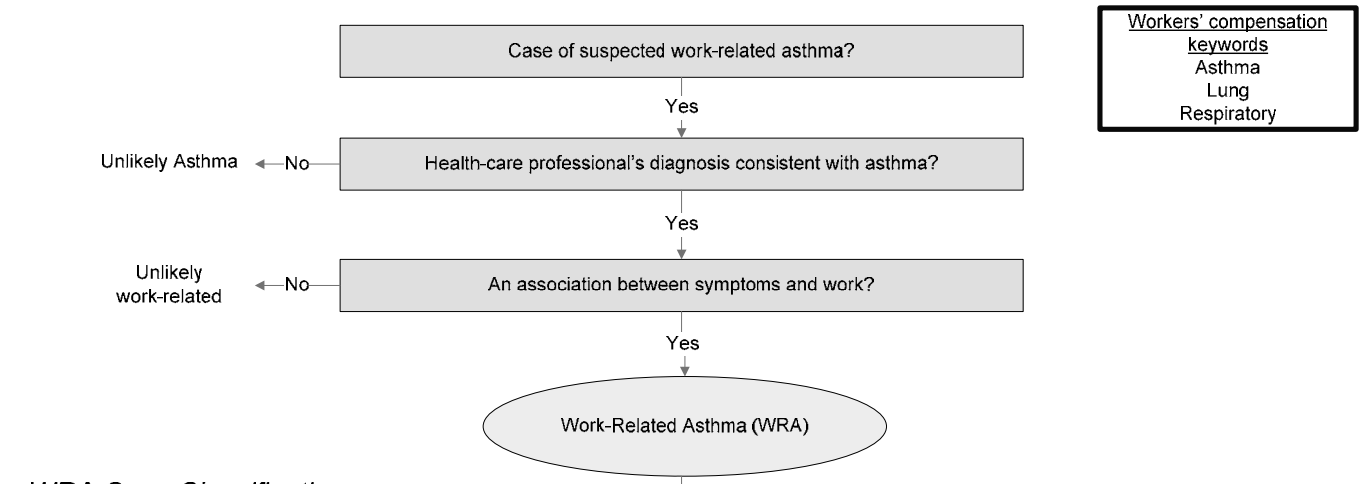
Measure	Criteria	Numerator	Denominator	Result
Lifetime Prevalence or work-related asthma	Told by a medical professional that their asthma was related to any job they ever had	# answered YES	# who've ever had a job and report having asthma	11%
Severity	Changed or quit a job because chemicals, dust or fumes at work caused or made asthma worse	# answered YES	# who've ever had a job and report having asthma	7.4%

2004 Union survey responses for work-relatedness

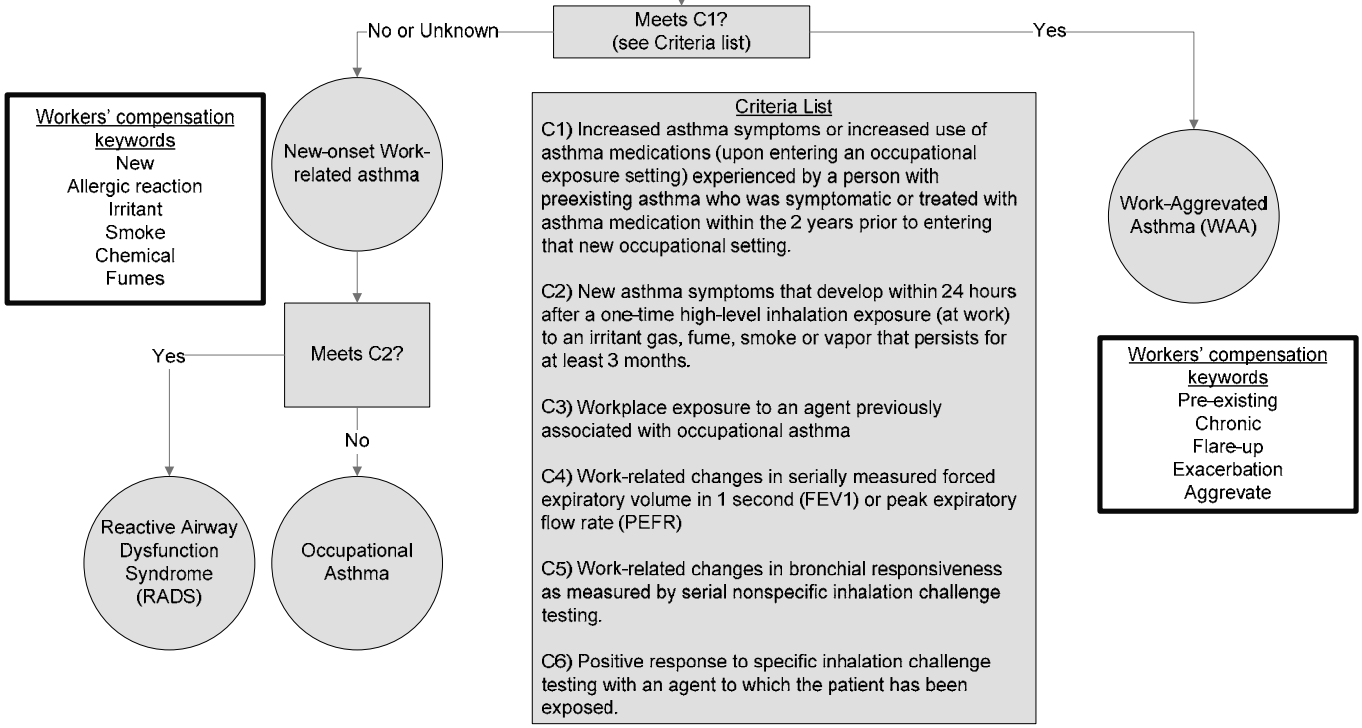
Measure	Criteria	Numerator	Denominator	Result
Lifetime Prevalence of work-related asthma	Told by a medical professional that their asthma was related to any job they ever had	# answered YES	# who've ever had a job and report having asthma	13.6%

Work-related Asthma Case Definition and Case Classification

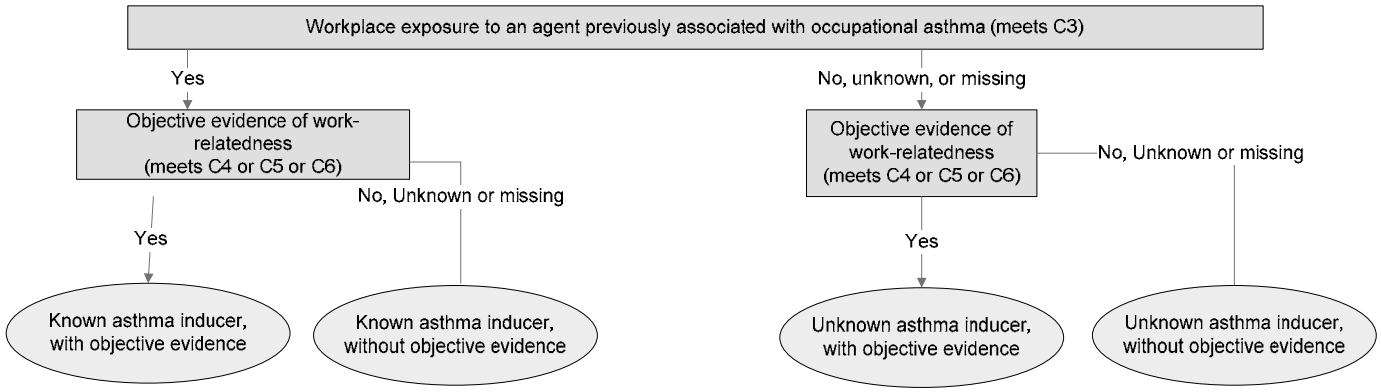
Case Identification



WRA Case Classification



Occupational Asthma Subclassification



CDC. MMWR: Morbidity & Mortality Weekly Report; 06/25/99 Supplement SS-3, Vol. 48 Issue 24

Vital Records/Death Records

Among the first administrative databases used to understand the nature and extent of health and safety issues were vital statistics records. Vital records are records of life events such as births, deaths, marriages and divorces. Deaths in Wisconsin are reported by the county vital records offices and by two city health offices to DHS. Death records are completed by physicians, coroners, funeral directors or county or city health officers. These records are by DHS' Bureau of Health Information and Policy (BHIP). While death records may include the occupation and industry of the deceased, this information is not keyed as part of the electronic record. As such, drawing conclusions from death records about the entire population can be problematic.

Strengths of this dataset include the richness of data. Information on race/ethnicity, education is included. Zip-code-level analysis often can provide findings of interest to planners and policymakers.

One weakness of these data is the relatively small number of records. In some cases, data may be aggregated to protect confidentiality. This makes it difficult to associate the findings to the general population.

Other Data Sources

Surveys

A survey is another type of non experimental descriptive study where inferences about behavior are made from data collected via interviews or questionnaires. If large enough, surveys are likely the best way to obtain the most accurate information about the prevalence of work-related asthma in Wisconsin. Surveys are particularly useful for assessing events that are difficult to directly observe and when it is desirable to sample a large number of subjects. The major limitation of survey data is in the methodology used to collect the data. Surveys rely on self-reporting, and intentional deception, poor memory or misunderstanding of the questions asked can all contribute to inaccuracies and bias in the data. Further more, the descriptive nature of survey data may make assessments of causality difficult.

Between 2003 and 2004, the occupational health surveillance program conducted a survey of unionized workers to gather information about asthma diagnosis and allergen exposures in Wisconsin workplaces. A total of 1,837 surveys were completed and analyzed (Islam, 2004).

Environmental Information

It is known that other environmental factors can exacerbate and contribute to the severity of asthma while at work. These include smoking, exposure to environmental tobacco smoke, particulate matter, and ozone. Particulate matter and ozone can be significant environmental asthma triggers. Data on these pollutants can be obtained from the Wisconsin Department of Natural Resources real-time mapping website for particulate matter and ozone, which is at http://dnrmaps.wisconsin.gov/imf/imf.jsp?site=wisards

Census Information

To determine the denominator for crude rates, the 2000 census Wisconsin population for those over 18 was used. Age-adjusted rates were also determined using the 2000 census data for each age category. Information specific to counties was obtained from the Wisconsin county profiles available at http://dwd.wisconsin.gov/oea/county_profiles/archived.htm.

Scientific Literature

The experience of others' research, especially of states similar to Wisconsin can be a good starting point to estimate or investigate WRA, by applying findings to Wisconsin.

CDC/NIOSH. Worker Health Chartbook, 2004.

Goe, SK, Henneberger PK, Reilly MJ, Rosenman KD, et al. A descriptive study of work aggravated asthma. 2004. Occup Environ Med Jun; 61(6):512-7

Saarinen, K., Karjalainen, A., Martikainen, R. et.al. Prevalence of work aggravated symptoms in clinically established asthma. 2003 Eur Respir J 22:305-309

Youakim, Sami, 2001. Work-Related Asthma. Am Fam Physician Vol 64, No 11, December 12, 2001, 1839-1848.

Wisconsin Department of Health and Family Services. 2007. Burden of Asthma in Wisconsin

Results

National studies suggest that up to 23% of workers who have asthma have been confirmed as having work-related asthma by their medical provider. The *2007 Burden of Asthma in Wisconsin* reports that the 2005 lifetime prevalence rate for asthma for individuals aged 18 years and older in Wisconsin is 13% of the population, or approximately 550,000 individuals. If an average of 15% of those who have asthma have work-related asthma, we can estimate that approximately 71,000 adult residents of Wisconsin can be considered to have *work-related* asthma.

Because no single data source can accurately capture all the information needed to for comprehensive surveillance for work-related asthma, a number of data sources were used to obtain the results used for this report. Timeframes for each dataset may differ, therefore, care must be taken to ensure that accurate comparison and interpretation. While the use of multiple data sources may improve prevalence estimates, these surveillance values likely represent a significant underestimate of health events in Wisconsin that are attributable to work-related asthma.

Workers' compensation data summary: From 1999 to 2006 the total number of workers' compensation claims submitted has gone down, as has the number of claims for asthma. However the proportion (rate) of workplace asthma claims has increased. From 1999 to 2006, the rate increased from 57/100,000 claims to 75/100,000 claims. According to 1999-2006 WC data, 59% of claims for asthma caused or exacerbated by work were reported for women. Workers in the manufacturing and services industry were the most likely to submit a claim.

Hospital discharge data summary: The number of Wisconsin hospitalizations for asthma that were paid by workers compensation was low and varied from year to year. 1999 had the highest number with six. That number has decreased through the years studied to two hospitalizations for asthma paid by workers compensation in 2006, the last year studied. Caucasian females have been hospitalized with asthma with workers compensation paying the bill. The age group most often hospitalized is 45-54 years old.

Emergency department visit data summary: In Wisconsin a similar pattern was found to the hospital discharge records. Since 2002 when emergency department visit data became available through 2006, the number of visits to the emergency department for asthma treatment paid by workers compensation varied by year and ranged from 1-6 visits. The majority of visits to the emergency department were initiated by the patients (79%) as opposed to having a physician referral. As shown with other datasets, most workers who visit the emergency department for asthma are white women; however, those seen in the emergency department tend to be younger, with 64% of patients younger than 45 years of age.

BRFSS data summary: In Wisconsin, according to the 2006 BRFSS survey data, 11% of individuals who report having asthma report being told that their asthma was work-related. Of those, over 7% had asthma symptoms at work that were severe enough to make them quit their job or be placed in another position.

Vital records data summary: In Wisconsin, during the years 2000-2006, there were two fatalities that occurred in the workplace where the primary or the contributing cause of death was asthma. One occurred in 2000 and one in 2005.

Union survey data summary: 10.8% of survey respondents had a confirmed asthma diagnosis at some point in their life. Of those with asthma, 13.6% met our definition of occupational asthma. Of the general population in Wisconsin, the WRA prevalence rate was 1.4% Prevalence of asthma was higher in females; however, WRA diagnoses were equally distributed between genders. The mean age at diagnosis of WRA was 40 years. Among those diagnosed with WRA, 40% worked in the service industry and 56% worked in the manufacturing industry (Islam). Survey data showed that more than 50% of those with WRA used a respirator. The Wisconsin OHS Program is beginning a project to assess the work and health experiences of those who have been diagnosed with asthma and are required to wear respirators at work.

Discussion

This report makes use of available data to learn about the occurrence of WRA in Wisconsin – who is affected, when and where it occurs. The estimate of WRA in Wisconsin is consistent with the national average estimate of 15% of those with asthma can be considered to have WRA. All of the information obtained for this report can be utilized to provide the basis for developing and evaluating prevention activities and public health practices in order to reduce its occurrence. Recognition of WRA is also critical to manage adults with asthma.

Prevalence

Using the 2006 BRFSS survey data we find that the lifetime prevalence of WRA is 11% of those who report having asthma. This estimate is supported by the 2004 Wisconsin Union Survey which found 13.6% of workers with asthma were diagnosed as having work-related asthma. This is in alignment with data found in other states and in national literature.

Severity

Between 2002 through the end of 2006 there were 10 hospitalizations in the state for asthma paid by Wisconsin workers compensation. These ranged from 1 – 3 hospitalizations a year. Emergency department visits ranged from 1-6 visits a year during this time period.

Trends

Wisconsin workers compensation claims sibmitted have continued to decline between 1999 through 2006 the years included in this report. For asthma specifically, workers compensation claims paid for asthma in the workplace have also decreased. The rate of workers compensation claims for asthma declined from 57 per 100,000 claims in 1999 to 37 per 100,000 claims in 2006.

Costs

Total costs associated with paid workers compensation asthma claims in Wisconsin during this period is about $4.2 million with an average annual cost of about $ 520,000. Costs for individual claims ranged from $28 - $257,924 with a mean payment of $21,300.

Gender

According to the 2007 *Burden of Asthma* report, boys have higher asthma prevalence than girls, while women have higher asthma prevalence than men. Workers compensation asthma claims are more common for women than men, a rate of 113 per 100,000 claims. This is also supported by hospitalization and emergency department visit data which show a higher rate for asthma-related visits paid for by workers compensation higher in women than in men.

Age

Ages of those hospitalized for asthma and whose visit was paid for by workers' compensation ranged from 12 to 66, with the most asthma hospitalizations paid by workers' compensation reported for workers between the ages of 35 – 54 years. Workers who sought treatment in emergency departments for their asthma symptoms were of a median age of 41 years old. The median age for WRA inpatient hospitalizations was 46.

Race

In sheer numbers, most workers who seek treatment for asthma paid by workers compensation are white, not of Hispanic decent. However, when calculating crude rates for each racial category, a ratio of the number of occurrences in each racial category to the number of workers in each racial group, we see that Wisconsin's African-American workers have a higher rate of hospitalizations, emergency room visits and workers' compensation claims for asthma paid by workers' compensation than other racial groups.

Allergens

In Wisconsin, according to the *2004 Union Survey* (Islam, 2004), more than 50 % of the respondents identified dust, smoke and fumes as responsible for making breathing difficult in

their place of work. Others reported that physical conditions such as poor ventilation (18%), chemicals, vapor or gas (13%) or other non-identified (19%) substances caused their asthma or made their pre-existing asthma worse when they worked.

Others' research has shown that substances like flour and wood dust can become major health hazards when individuals are exposed to them in the workplace. By identifying and controlling exposures, WRA can be prevented. Studies have shown that diisocynates (e.g. truckbed liners), natural rubber latex (e.g. medical gloves), glutaraldehyde (e.g. disinfectants), molds, epoxy resins and cleaning agents are the most common substances that cause WRA. Some reports suggest that the total number of asthma sensitizers is increasing with many new substances being identified in the workplace. A short list of these substances has been compiled and is listed at http://nj.gov/health/eoh/survweb/wra/documents/asthmagens.pdf

Industries

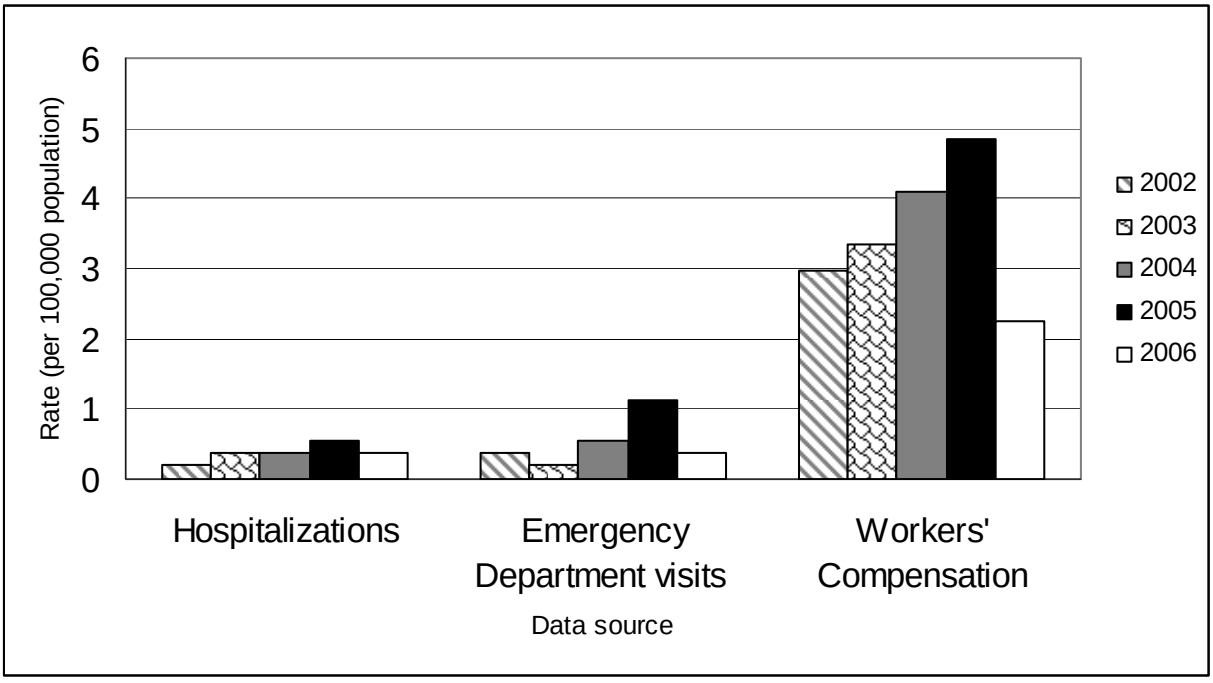
In Wisconsin, most WRA workers' compensation claims submitted come from workers in the manufacturing and services industries. Other asthma claims come from agriculture, public administration, managerial and transportation industries.

Research in three states in 1995 concurred with our findings in that the majority of allergen exposure occurring in the manufacturing and services industry (includes health and hospitality services) (CDC. MMWR, 1995).

Number of WI workers' compensation claims by asthma type, 1999-2005

		# of All Claims	Number of Asthma Claims		
			# New-onset asthma Claims	# Work-Aggregated Claims	# All Asthma Claims
Total # claims 1990-2006		325,078	155	41	196
Annual Average # claims		40,635	19	5	25
Year	1999	50,762	25	4	29
	2000	49,461	32	11	43
	2001	45,145	24	8	30
	2002	40,522	13	3	16
	2003	37,540	16	2	18
	2004	35,554	18	4	22
	2005	34,379	18	8	26

Rate of asthma paid by WI workers' compensation by data source, 2002-2006



WI Workers compensations claim cost for asthma, 1990-2006

	All Claims	Asthma Claims		
		All Asthma	New-onset	Work-aggravated
Total claims	325,078	196	155	41
Total cost		$4,174,766	$3,738,623	$436,143
Annual average cost		$521,846	$467,328	$54,518
Mean		$21,300	$24,120	$10,638
Minimum		$28	$36	$28
25th percentile		$638	$631	$683
Median		$2,404	$5,000	$1,076
75th percentile		$30,000	$35,000	$5,000
Maximum		$257,924	$257,924	$120,000

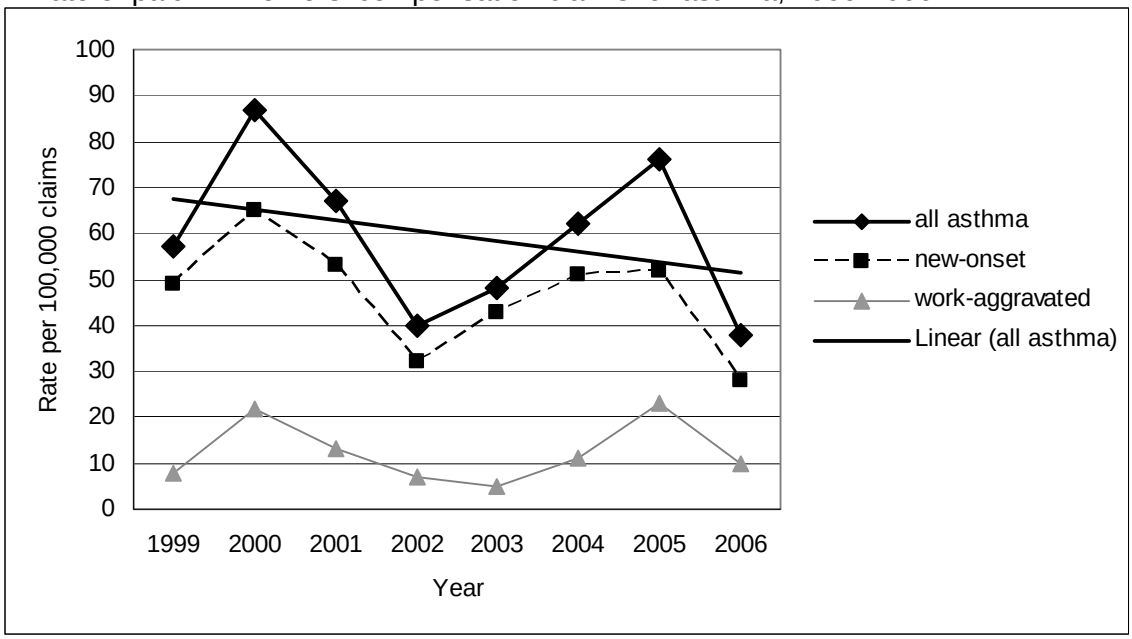
P-value = 0.03 using Kruskal-Wallis test

Number of hospitalizations and emergency department visits for asthma paid by WI workers' compensation, 1999-2005

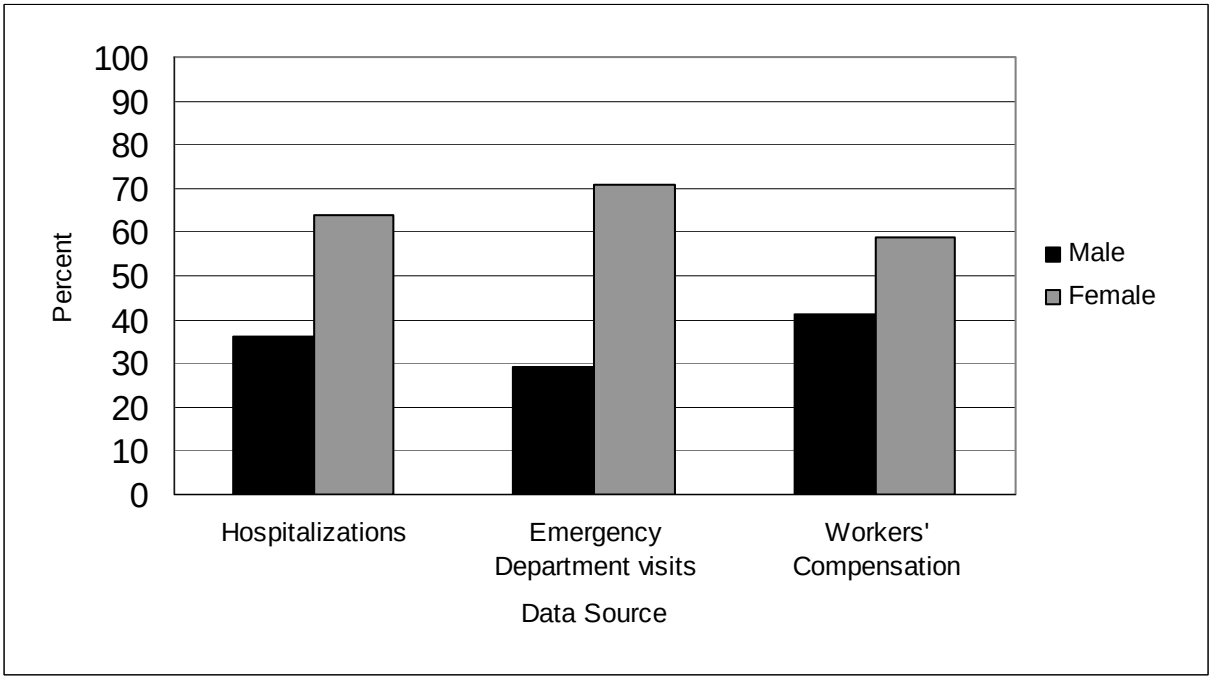
		All Hospitalizations	Asthma hospitalizations	Work-related asthma hospitalizations	Asthma emergency dept. visits	Work-related asthma emergency dept. visits
Year	1999	621,236	6,007	6	Data not available	Data not available
	2000	635,166	5,685	3		
	2001	648,015	5,417	0		
	2002	651,919	5,149	1	22,474	2
	2003	663,298	5,954	2	23,117	1
	2004	670,247	5,256	2	21,401	3
	2005	674,508	5,417	3	21,937	6

Source: WI hospital discharge data and emergency department visit data

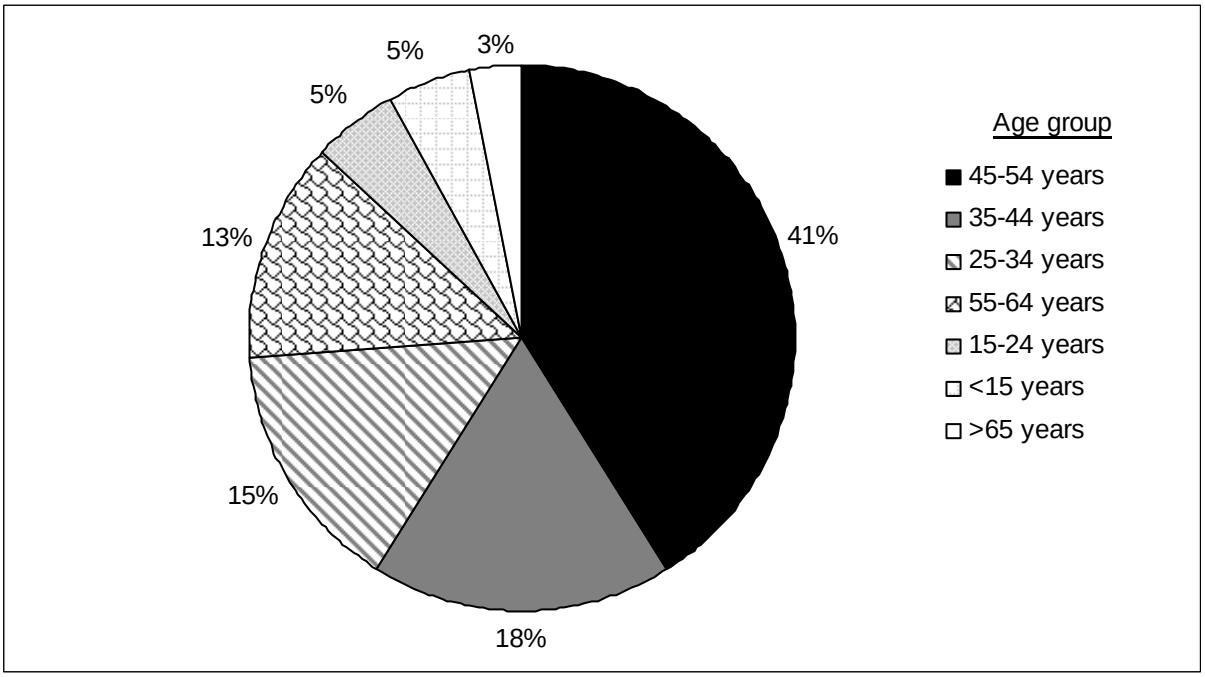
Rate of paid WI workers' compensation claims for asthma, 1999-2006



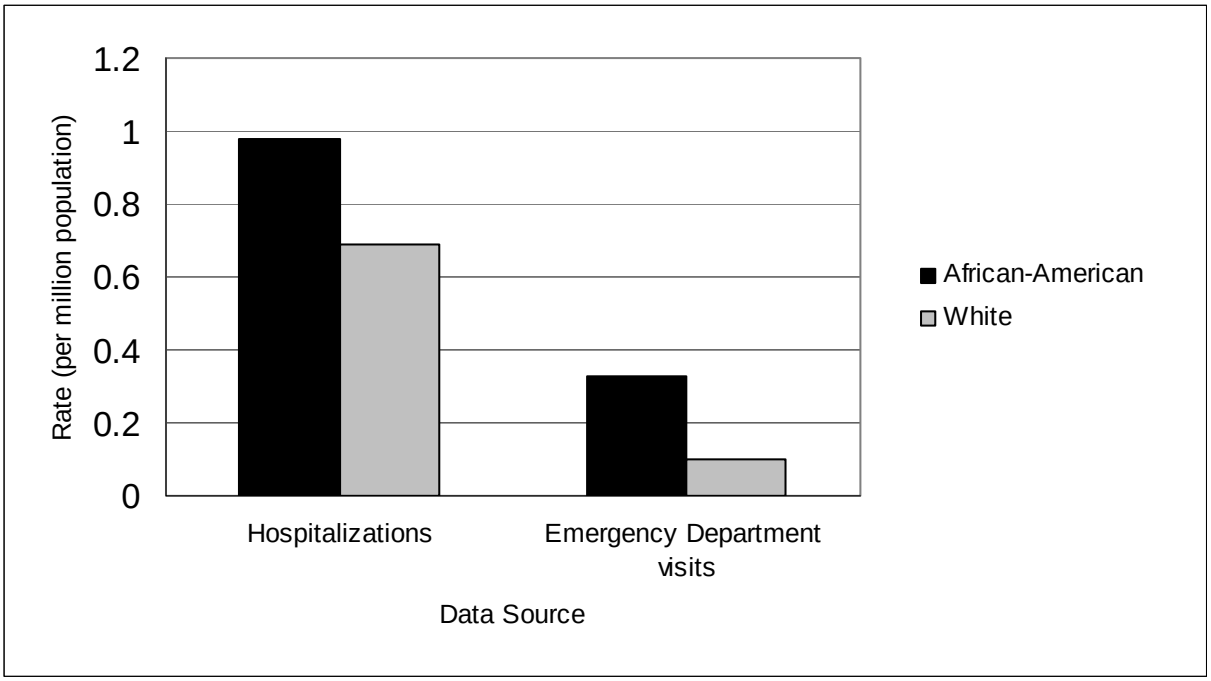
Percentage of asthma visits or claims paid by WI workers' compensation by gender and data source, 2002-2006



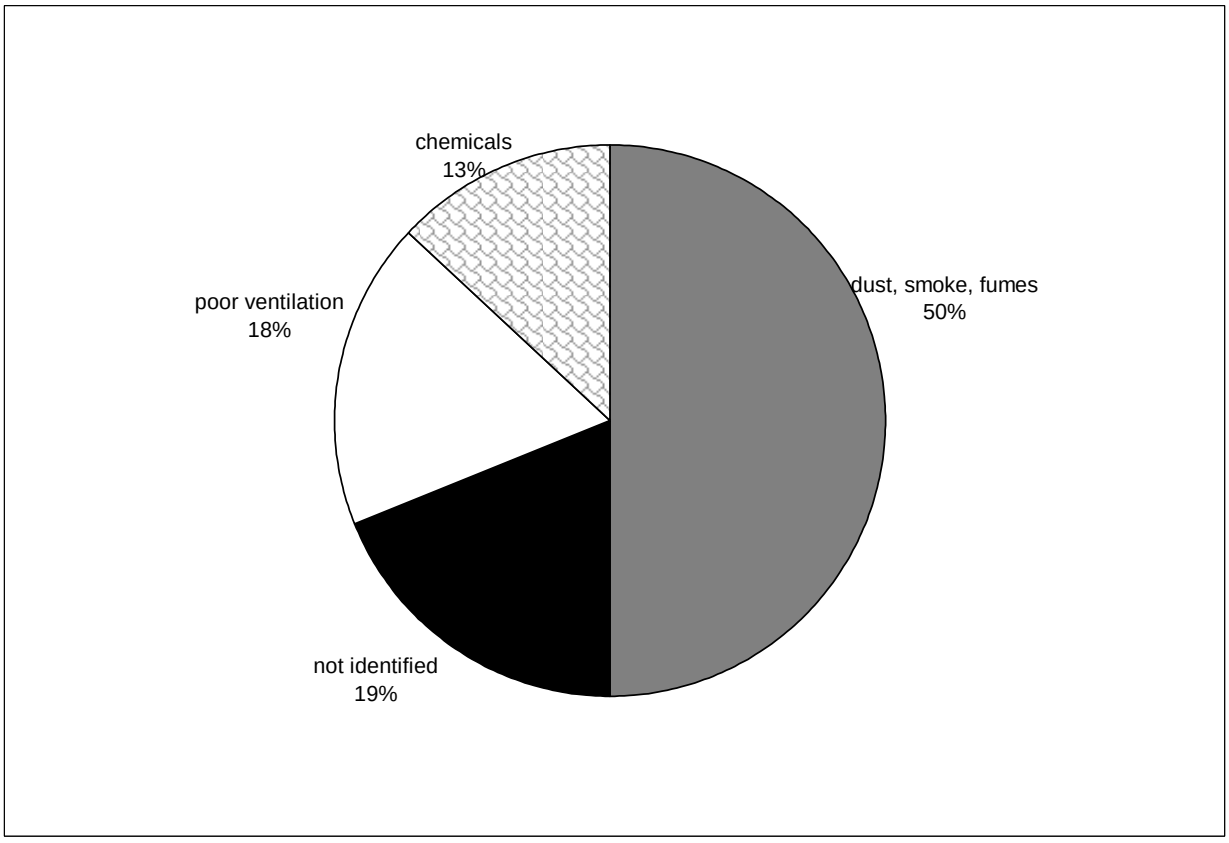
Percent of asthma hospitalization claims paid by WI workers' compensation by age group, 1991-2006



Race-specific rate of asthma hospitalizations and emergency department visits paid by WI workers' compensation, 2002-2006

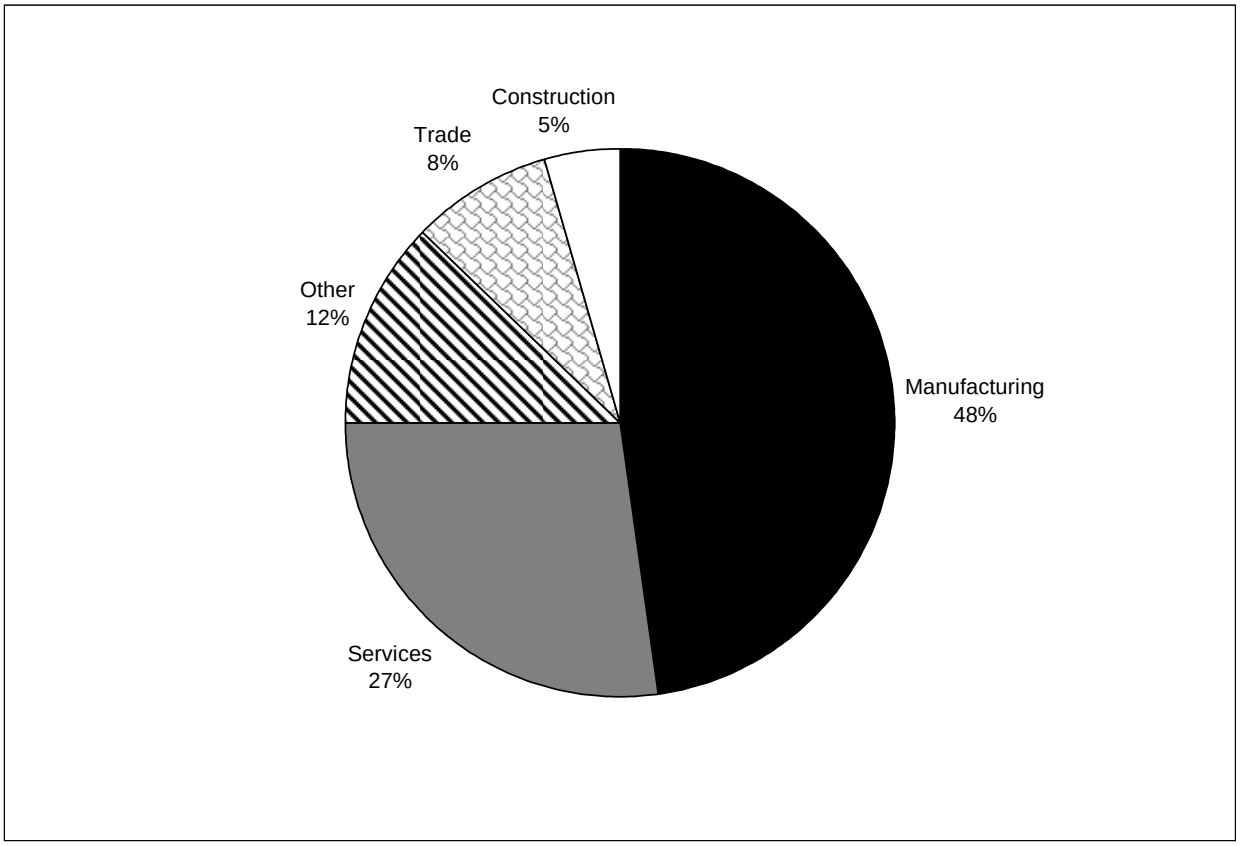


Common allergen exposures reported by unionized workers in Wisconsin, 2004



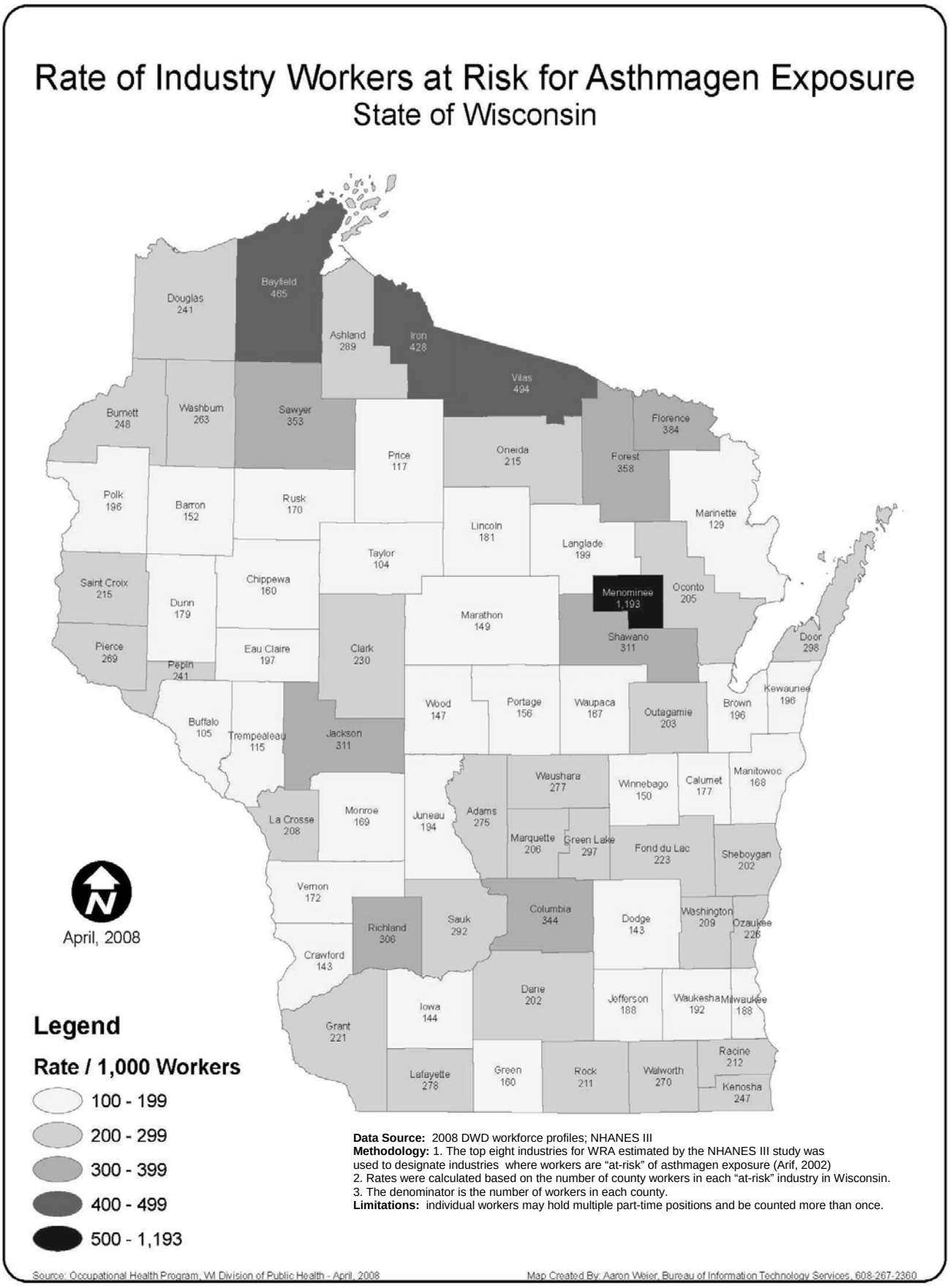
Source: 2004 WI Union Survey

Industries where Wisconsin workers' compensation claims for asthma were paid, 1999-2006



Source: 2004 WI Union Survey

Rate of workers “at-risk” of being exposed to asthmagens by Wisconsin county, 2008



Location of counties where emergency room visits occurred for asthma and were paid by workers' compensation, 2002-2006

Source: Bureau of Environmental and Occupational Health, Division of Public Health, Wisconsin Department of Health Services

Case Reports

A health hazard evaluation (HHE) is a study of a workplace conducted they NIOSH. It is done to learn whether workers are exposed to hazardous materials or harmful conditions. When an HHE is done, NIOSH staff visit the workplace to tour the facilit y, review records, measur e exposure, interview or survey employees and they may do medical testing. These activities happen during one or m ore visits. At the end of this evaluation, NIOSH will provide a written report to the employ er and to the em ployee representatives. An HHE can take from a few months to a few years to complete depending on the type of evaluation.

An employee can request an HHE if he or she is currently employed at the workplace of concern and has the signatures of two other em ployees. If the workplace has thre e or fewer employees, the signature of onl y one employ ee is enough. An offi cer of a labo r union t hat represents employees for collective bargaining can request an HHE. Any management official may request an HHE on behalf of the employer. For any one who subm its a request, NI OSH will not reveal to the em ployer the names of the persons who made the request if they indicate this on the request form.

The following final report summari es are taken directly from NIOSH health hazard evaluation (HHE) reports of investigations in Wisconsin workplaces.

Chemicals in Manufacturing

Case 1. Report: HETA-2005-0243-3016

On May 17, 2005, the National Institute for Occupational Safety and Health (NIOSH) received a confidential request fr om three employees at ACH Foam Technologies in Fond du Lac, Wisconsin. The requestors expressed concerns about potential long-term effects from exposure to sm oke and chemicals generated while manufacturing pol ystyrene and cutting polyethylene sheeting and expandable polystyrene (EPS) foam. On August 31, 2005, NIOSH investigators sampled for che mical byproducts from the EPS processes at t he ACH facility. Personal breathing zone (PBZ) and area air samples were collect ed for pentane, styrene, volatile organic co mpounds (VOCs), and respirable and total dust. Air samples collected on thermal d esorption tubes identified pentane, styrene, acetophenone, ethylbenzene, and xylene as predominant chemicals. The charc oal tubes used to sample for VOCs were submitted for laboratory analysis for a cetophenone, ethylbenzene, and xylene. Area conce ntrations of carbon monoxide, a potential byproduct from the EPS pr ocesses, were measured in several departments with a direct reading ins trument. All sample results were below applicable occupational exposure lim its. NIOSH investigators conclude that a health hazard did not exist o n the da y of this evaluation. Employees were not exposed over applicable occupational exposure limits to carbon monoxide, pentane, styrene, aceto phenone, ethylbenzene, xylene, respirable dust, or total dust while m olding and cutting EPS products. Recommendations in this report include providing local exhaust ventilation i n the hot wire cutting area, repairing dam aged duct work in the Recy cling department, and im proving communication between supervis ors and employees.

A full NIOSH report can be found at: http://www.cdc.gov/niosh/hhe/reports/pdfs/2005-0243-3016.pdf

Case 2. Report: HETA-2005-0029-2923

On October 18, 2002, the National Institute for Occupational Safety and Health (NIOSH) received a c onfidential employee request for a health hazard evaluation (HHE) at W ard Brodt Music Mall in Madison, Wisconsin. The request centered on workers' exposures to acids and solvents during m usical instrument repair operations, the adequacy of the ventilation in the chemical room, and reported sy mptoms of sore throat, sinus headaches, congestion, asth ma, persistent cough, allergies, sneezing, and watery eyes. On January 14, 2003, NIOSH investigators conducted an exposure assessment and interviewed repair shop workers. Between the time of the HHE request and the site vi sit, local exhaust ventilation was installed in the chemical

room. Personal breathing zone and general area air samples were collected and anal yzed for inorganic acids (hy drochloric, nitric, and sulfuric) and volatile organic com pounds (VOCs). Thermal desorption tubes were used qualitatively to determ ine the co mpounds to analyze. A ventilation assessment consisted of "smoke" tube observations and velometer measurements. Hydrochloric acid concentrations ranged from not detected (ND) to 0.0 49 milligrams per cubic meter (mg/m^3) and nitric acid concentrations ranged from ND to 0.035 mg/m^3. Sulfuric acid concentrations could not be determined due to analy tical problems. Based upon thermal desorption tube results, the VOC samples were anal yzed for toluene, trichloroethylene (TCE), and total VOCs (reported as octane). Toluene concentrations ranged from 0.06 to 0.29 parts per million (ppm), TCE concentrations ranged from trace to 0.99 ppm, and total VOC concentrations ranged from trace to 0.35 ppm. All of these results were far below applicable occupational exposure limits. Ventilation testing using visual "sm oke" indicated little air movement over the workbenches and around mechanical equipment. A ventilation assessment of the slot hood in the chemical room found it within recommended standards. Although no applicable standards exist for the ventilation s ystems in the buffing and lacquer rooms, each area was under negative pressure in relationship to the repair shop.

Confidential interviews were conducted with repair shop em ployees. Of the seven br ass and woodwind shop em ployees interviewed, three had experienced upper an d/or lower respiratory symptoms they felt were related to acid mist exposure from the chemical room . Two of the three had complete resolution of their symptoms after a new ventilation s ystem was inst alled. At least two of the seven have had mild to moderate skin irritation related to their work. These symptoms reportedly improved with skin moisturizers and glove use. Em ployees' reports of upper and lower respiratory symptoms could be related to the l ow concentrations of air contaminants measured. It is possible that the reported symptoms were related to hig her concentration of the irritants that may have been present in the repair shop prior to i nstallation of the new ventilation s ystem. Recommendations are provided to further reduce e mployees' exposures to these chem icals by increasing the level of personal protection for workers in the repair shop, and im proving ventilation and work practices in the facility.

Keywords: SIC Code 7699 (Repair Shops and Related Services, Not Elsewhere Classified), musical instrument repair, inorgani c acid, hydrochloric acid, sulfu ric acid, nit ric acid, toluene, trichloroethylene, TCE, sore throat, headaches, congestion, asthma, cough, allergies, sneezing, watery eyes, upper r espiratory symptoms, lower respirator y symptoms, skin irritation.

A full NIOSH report can be found at: http://www.cdc.gov/niosh/hhe/reports/pdfs/2003-0029-2923.pdf

Bioaerosols

Case 1. Report HETA 99-0091-2846

On January 29, 1999, the National Institute for Occupational Safety and Health (NIOSH) received a confidential employee request for a Health Hazard Evaluation (HHE) at the Plover, Wisconsin, facility of McCain Foods, Inc., a plant which produces frozen potato products. The requesters expressed concern regarding possible health effects, especially respiratory problems, which they believed were associated with exposures to carbon monoxide (CO), chlorine gas (Cl2), and unknown chemicals. On March 30, 1999, a preliminary NIOSH investigation focused on the potential for Cl2, and CO exposures. Screening tests for the presence of both chemicals in air were negative. However, informal worker interviews suggested that health problems might be widespread. During a July 25-26, 1999, site visit, NIOSH researchers investigated whether the health effects were related to bioaerosols, such as bacteria, fungi, or their products (especially endotoxins, which are components of the coats of gram-negative bacteria). A questionnaire survey of workers was conducted to determine the frequency of respiratory and other health symptoms and full-shift, personal breathing zone (PBZ) samples were collected to estimate time-weighted average (TWA) concentrations of airborne particulates and endotoxin. Data was categorized by whether it was collected in the potato processing areas or in the packaging areas of the plant. The questionnaire survey of 115 of 185 workers found the prevalence of chest tightness was more than 2.5 times greater in the processing workers than the packaging workers (39% versus 14%, prevalence rate [PR] = 2.8, 95% confidence interval [CI]: 1.36-5.75). Processing employees also had twice the prevalence of shortness of breath (43% versus 18%, PR = 2.4, 95% CI: 1.29-4.63), twice the prevalence of pneumonia or chest flu episodes (48% versus 25%, PR = 2.0, 95% CI: 1.16-3.33), and one and one-half times the prevalence of eye, nose, or throat irritation (55% versus 33%, PR = 1.7, 95% CI: 1.07-2.57) compared to packaging employees. These findings remained statistically significant after controlling for the confounding factors of age and cigarette smoking. Airborne endotoxin concentrations in the processing area greatly exceeded those in the packaging area. PBZ endotoxin concentrations in the processing area of the plant averaged 168 endotoxin units per cubic meter (EU/m3), but those in the packaging area were less than the lower limit of detection (0.018 EU/m3). A likely source of bacteria, and, therefore, endotoxins, is a wastewater gutter system located throughout the processing area of the plant.

Case 2. A Health Hazard Evaluation (HHE) was conducted on April 14–16, 1997, by the National Institute for Occupational Safety and Health (NIOSH) at Especially for You, Limited, located in Coloma, Wisconsin. This HHE was conducted following a confidential employee request regarding styrene vapor and sanding dust exposure in the Resin and Finishing department. The company manufactures a variety of home decorative items including plastic articles by curing polyester resin in preformed molds.

Air monitoring was conducted during the manufacturing activities for volatile organic compounds (VOCs), styrene, Stoddard solvent, methyl ethyl ketone peroxide (MEKP) as well as respirable and total dust. Personal breathing zone (PBZ) samples collected when workers were mixing and pouring liquid resin revealed that full–shift exposure concentrations to styrene ranged from 15 to 46 parts per million (ppm); some of the exposures exceeded the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value® (TLV) for styrene of 20 ppm and approached the NIOSH Recommended Exposure Limit (REL) of 50 ppm. In addition, short–term PBZ exposure to styrene during resin mixing exceeded both the ACGIH 15–minute Short–Term Exposure Limit (STEL) of 40 ppm and the NIOSH STEL of 100 ppm. Gas chromatograpy–mass spectrophotometry (GC–MS) analyses identified other VOCs present in the air as a mixture of aliphatic hydrocarbons which produced a chromatogram pattern resembling Stoddard solvent. However, PBZ exposure to Stoddard solvent was determined to be well below relevant occupational health criteria. Area samples collected for MEKP did not detect this compound at "worst–case" locations when the (MEKP) accelerator was added to the resin. Full–shift exposure concentrations to total particulates during

sanding and finishing tasks ranged from 1.7 to 8.0 mg/m3.

Although these dust exposures were below the ACGIH TLV, the use of a pain t spray booth for exhaust of belt sander dust may not always be effective for control of workers' dust exposure. NIOSH investigators concluded that a potential health hazard exists fro m exposure to styrene vapor during resin mixing and mold pouring activities. A nu mber of recommendations are provided including improved local exhaust ventilation, periodic exposure monitoring, a m ore effective respiratory protection program , and safer chemical storage methods.

What can be done about WRA in Wisconsin?

Minimizing or eliminating worker exposures to asthma-causing agents can preven t work-related asthma. This can be done by:

- minimizing exposure;
- substituting chemicals known to cause asthma for those that do not cause asthma;
- improving ventilation in the work area;
- using engineering controls such as equipment that does not produce smoke or fumes;
- use effective respiratory protection equipment;
- training on the correct use of protective equipment;
- recognizing asthma-causing substances;
- recognizing the signs of breathing problems
- participate in medical screening and tracking programs, and;
- report to your physician any breathing problems.

For more information go to:
http://www.cdc.gov/niosh/topics/asthma/OccAsthmaPrevention-primer.html

Myths About Work-Related Asthma

Myth: "It's their own cigarette smoking habits that caused their work-related asthma."
Fact: Smoking does not increase the risk of getting work-related asthma. Some studies have found a shorter time to the development of asthma in smokers but both smokers and non-smokers have developed work-related asthma.

Myth: "The company says they've done air testing and they are within OSHA limits – it must not be work-related asthma."
Fact: Workplace standards have not been developed for all substances that could cause work-related asthma. Work-related asthma may also develop by small exposures over time.

Myth: A proper pre-screening would prevent people from being hired into workplaces where they develop work-related asthma."
Fact: To date, no combination of pre-placement testing (medical history, skin testing, or breathing tests) has been able to adequately predict who will develop work-related asthma. Also, because of the way this testing is designed, it would exclude a large number of people from working with substances that could cause work-related asthma, but these people would never actually develop work-related asthma.

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