NIOSH

ALERT

Preventing Asthma in Animal Handlers

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

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NIOSH ALERT

Preventing Asthma in Animal Handlers

WARNING!

Exposure to animals or animal products in the workplace can cause asthma and allergies.

Animal handlers should take steps to protect themselves from exposure to animals and animal products:

- Perform animal manipulations within ventilated hoods or safety cabinets when possible.
- Avoid wearing street clothes while working with animals.
- Leave work clothes at the workplace to avoid potential exposure problems for family members.
- Keep cages and animal areas clean.
- Reduce skin contact with animal products such as dander, serum, and urine by using gloves, lab coats, and approved particulate respirators with faceshields.

Employers of animal handlers should take steps to protect workers from exposure to animals and animal products:

Modify ventilation and filtration systems:

- — Increase the ventilation rate and humidity in the animal-housing areas.
- — Ventilate animal-housing and -handling areas separately from the rest of the facility.
- — Direct airflow away from workers and toward the backs of the animal cages.
- — Install ventilated animal cage racks or filter-top animal cages.

- Decrease animal density (number of animals per cubic meter of room volume).
- Keep cages and animal areas clean.
- Use absorbent pads for bedding. If these are not available, use corncob bedding instead of sawdust bedding.
- Use an animal species or sex that is known to be less allergenic than others.
- Provide protective equipment for animal handlers—gloves, lab coats, and approved particulate. respirators with faceshields.
- Provide training to educate workers about animal allergies and steps for risk reduction.
- Provide health monitoring and appropriate counseling and medical followup for workers who have become sensitized or have developed allergy symptoms.

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WARNING!

Exposure to animals or animal products in the workplace can cause asthma and allergies!

The National Institute for Occupational Safety and Health (NIOSH) requests assistance in preventing asthma and allergies in animal handlers. Approximately 2 million workers have jobs that require constant contact with animals or animal products [Brooks 1992]. About 33% of animal handlers have allergic symptoms, and approximately 10% have symptoms of animal-induced asthma [Chan-Yeung and Malo 1994]. Animals or animal products such as dander, hair, scales, fur, saliva, and body wastes contain powerful allergens that can cause both respiratory and skin disorders. Workers at risk include laboratory animal and veterinary technicians, researchers, veterinarians, and others who have prolonged, close association with animals or their secretions or excretions. Also at risk are workers who handle animal products or associated materials such as bedding and feed.

This Alert describes three case reports of workers affected by exposures to animals. The recommendations presented here can help reduce such exposures and prevent animal-induced asthma and allergies.

BACKGROUND

Animal-related asthma and allergies are exaggerated reactions of the body's immune system to animal proteins, also known as allergens. Sources of these allergens include animal dander, scales, fur, body wastes, and saliva [Bardana 1992; Lincoln et al. 1974].

Inhalation is one of the most common ways for allergens to enter the body. After a period of time (often several months, but occasionally many years), workers may inhale sufficient quantities of allergens to become sensitized—that is, they develop symptoms when exposed again, even to tiny amounts of the allergen [Bardana 1992; Chan-Yeung and Malo 1994]. Airborne exposures to dusts derived from animals are not currently regulated to protect workers from developing allergic problems.

The diagnosis of animal allergy or sensitization is made using skin-prick tests, blood antibody tests, and other methods. Symptoms vary among workers who have become sensitized to animals. Mild reactions include sneezing and runny nose. More serious reactions to an inhaled allergen may result in asthma symptoms such as cough, chest tightness, wheezing, or shortness of breath. In sensitized workers, reactions often occur soon after exposure to the

animal or animal product, but they may be delayed for 2 to 8 hours or more.

A worker who has developed asthma symptoms from animal allergies often improves or recovers completely if he or she immediately stops being exposed to dusts containing the animal allergens. However, the longer the exposures continue, the more likely the illness will persist, even after all contact with animals has stopped.

Symptoms from animal-related asthma and allergies can be severe and may require affected workers to change jobs or careers [Bardana 1992]. Affected workers and their employers must bear the costs for treatment, time lost from work, and temporary or even permanent disability [Newill et al. 1986].

COMMON SOURCES OF EXPOSURE

Sources of exposure to animal allergens vary with animal species. For example, the most important allergens have been found in the urine of rats and in the urine, saliva, and pelts of guinea pigs [Chan-Yeung and Malo 1994]. Rat urine contains significant amounts of a protein that is also found in dust samples from ventilation systems of animal facilities [Bardana 1992]. Other important sources of allergen exposure include rabbit pelts, cat saliva and dander, dog dander, and horse serum and dander [Bardana 1992].

Exposures to rats, mice, and rabbits have frequently been associated with the development of occupational asthma. Species other than mammals have also been reported to cause respiratory symptoms—various insects, for example, and frogs (which are commonly used in science classes) [Bardana 1992]. Exposures to birds have been associated with other respiratory diseases, including hypersensitivity pneumonitis [Parker et al. 1992]. A person who becomes allergic to one animal species may react to other species as well. Even a low exposure to these common sources of animal allergens can result in allergies, but the risk increases as the worker's exposure increases [Hollander et al. 1997].

TYPES OF ANIMAL HANDLERS AT RISK

All animal handlers appear to be at risk for developing work-related allergy symptoms. However, workers who had symptoms or signs of allergies before they were employed as animal handlers are more likely to develop animal-induced asthma [Beckett 1994; Chan-Yeung and Malo 1994]. Allergic workers, particularly those sensitized to domestic animals such as cats and dogs, are more likely to develop sensitivity to laboratory animals and asthma than nonallergic workers [Bryant et al. 1995].

Studies of workers exposed to animals associate many occupations with an increased risk of asthma and other respiratory symptoms [Lutsky et al. 1985; Zejda et al. 1993; Zuskin et al. 1992a,b; Bar-Sela et al. 1984]. These occupations include laboratory animal workers, veterinarians, livestock workers, garment workers, and horse handlers. Risks associated with some of these occupations are outlined here.

Laboratory Animal Workers

Workers are exposed to laboratory animals in the pharmaceutical industry, university laboratories, research units, and

animal breeding facilities [Chan-Yeung and Malo 1994]. Most reactions to exposures in these facilities involve small animals such as rodents. Reactions associated with primates, cats, dogs, and domestic farm animals have also been reported [Lincoln et al. 1974].

Animal contact occurs during feeding, cleaning, dosing, sacrifice, surgery, and body fluid collection, measurement, and transport through the facilities [Harries and Cromwell 1982]. Workers are exposed to animal dander, hair, urine, saliva, tissues, and sera [Harries and Cromwell 1982].

Animal-related allergy is one of the most important health hazards encountered by laboratory animal workers [Newman-Taylor and Gordon 1993]. Health surveys of persons currently working with laboratory animals indicate that up to 56% are affected by animal-related allergies [Aoyama et al. 1992; Bardana 1992; Bryant et al. 1995; Hunskaar and Fosse 1993; Kibby et al. 1989; Lutsky et al. 1985; Newill et al. 1986; Zejda et al. 1993]. In a survey of 5,641 workers from 137 animal facilities, 23% had allergic symptoms related to laboratory animals. Of the workers with symptoms, 82% had nasal or eye symptoms, 46% had skin complaints, and 33% had asthma. These figures do not include former workers who became ill and could not continue to work.

Veterinarians and Veterinary Technicians

Increased prevalences of asthma, respiratory infections, and obstructive lung disease have been observed in veterinarians. Those who work with large animals seem to have fewer problems with asthma and allergies than those who work with small animals [Lutsky et al. 1985].

Livestock Workers

Rhinitis and occupational asthma are recognized effects of working with livestock such as cattle, hogs, sheep, and goats. Hog producers—particularly those who work in large confinement areas with inadequate ventilation—have been shown to develop wheezing and chronic coughing [Zejda et al. 1993; Zuskin et al. 1992b].

Garment Workers

Workers in the garment industry may have allergic reactions to pelts and fur as well as to textiles made from animal products such as wool, cashmere, alpaca, vicuna, and mohair [Bardana 1992].

Horse Handlers

Horse exposure poses a risk to agricultural workers, mounted law enforcement units, and race track and stable attendants.

HEALTH EFFECTS

Exposure to airborne animal allergens may at first result in nasal, eye, and throat irritation as well as skin hives [Ohman 1978; Lincoln et al. 1974]. As many as 50% of workers with these symptoms go on to develop asthma symptoms such as recurrent episodes of coughing, wheezing, chest tightness, and difficult breathing [Bardana 1992]. Nasal symptoms usually develop first; occupational asthma without nasal symptoms is uncommon. Once an individual has become sensitized to animals, allergy symptoms can occur after only a few minutes of exposure, or they may be delayed up to 8 hours or more. In severe cases, anaphylactic reactions (including shock) may develop, although rarely.

Symptoms of asthma may first appear long after beginning work with animals.

Laboratory animal allergy usually develops within 36 months of starting exposure, and most cases develop after 6 to 36 months of exposure. Animal workers who do not become allergic within 3 years of exposure are less likely to develop the problem after longer exposures [Aoyama et al. 1992]. However, a study of 16 poultry workers with symptoms of asthma and rhinitis showed that the onset of symptoms can be delayed for up to 10 years [Bar-Sela et al. 1984].

After exposure is terminated, the nasal and eye symptoms often disappear shortly, but the lung symptoms tend to persist [Newman-Taylor and Gordon 1993]. In the poultry workers, nasal symptoms and asthma were persistent even after affected workers left the poultry house [Bar-Sela et al. 1984].

CASE REPORTS

Case 1—Exposure to Laboratory Rats

A 21-year-old female worker at a pharmaceutical company prepared rats for experiments. She had no prior respiratory illnesses, but she had a family history of allergies. Three months after she started working, the worker noted hives on her forearms and hands. Her symptoms worsened until every direct contact with rats produced hives. Wearing gloves alleviated the problem, but she could not perform her work adequately when using them.

The worker then began to suffer episodes of sneezing, nasal drainage, watery eyes, and chest tightness. She was transferred to another department, where her symptoms ceased. However, they recurred if she entered a room with rats or where rats had previously been housed. The worker had positive skin tests to animal dander and to rat hair. She also had elevated antibodies (IgE) to various rat proteins [DeGroot and Messerschmidt 1984].

Case 2—Exposure to Rabbits

A 32-year-old physician had been working on a research project involving rabbits for 2½ years. He had an allergy to cats but not to dust mites or other common allergens. The physician developed progressively worsening nasal congestion and eye irritation. During work with a rabbit, he received an accidental needlestick. Within 15 minutes, the physician noted progressive itching, swelling of the face, hives, throat tightness, and inability to speak. He was admitted to the hospital where he received emergency treatment for anaphylactic shock. His symptoms stabilized over a 5-hour period. Blood samples showed increased antibodies (IgE) to cat dander and rabbit epithelium. The antibodies to rabbit epithelium declined over the 6-month period after he left the job that involved rabbit contact [Watt and McSharry 1996].

Case 3—Exposure to Various Animals

Thirty-eight students were examined during their first year of training as laboratory technicians (median age was 21 years). They were re-examined after working with various laboratory animals (primarily rats, mice, and rabbits) for an average of 18 months. At that time, nine students (24%) had developed allergies to laboratory animals. Symptoms included nasal and eye irritation in seven students, skin rashes in four, and chest problems in three. Of the nine students with animal allergies, seven had reactions to rat or mouse antigen in skin-prick tests, and eight showed asthma-like reactions during lung testing [Renström et al. 1995].

CONCLUSIONS

Asthma and other respiratory illnesses may develop in persons whose work requires close contact with animals and animal products. Asthma in animal handlers can result in respiratory symptoms that are severe and persistent. These symptoms can lead to permanent disability or require a career change. Workers at risk for developing symptoms should be advised to take precautions to avoid or minimize exposures. Several methods for reducing exposures and decreasing the risk of sensitization are available to employers and workers. Medical monitoring of exposed workers and remedial actions for workers with symptoms can further reduce the risk of permanent adverse health effects. With timely and appropriate action, many cases of animal-related asthma can be prevented.

RECOMMENDATIONS

NIOSH recommends the following measures to reduce exposures to animal allergens in the workplace and prevent animal-induced asthma and allergies:

1. Modify ventilation and filtration systems:
   - Increase the ventilation rate and humidity in the animal-housing areas.
   - Ventilate animal-housing and -handling areas separately from the rest of the facility.
   - Direct airflow away from workers and toward the backs of the animal cages.
   - Install ventilated animal cage racks or filter-top animal cages.
2. Perform animal manipulations within ventilated hoods or safety cabinets when possible.
3. Decrease animal density (number of animals per cubic meter of room volume).
4. Avoid wearing street clothes while working with animals. Leave work clothes at the workplace to avoid potential exposure problems for family members.
5. Keep cages and animal areas clean. Take particular care to control exposures during cleaning.
6. Use absorbent pads for bedding. If these are unavailable, use corncob bedding instead of sawdust bedding.
7. Use an animal species or sex that is known to be less allergenic than others.
8. Reduce skin contact with animal products such as dander, serum, and urine by using gloves, lab coats, and approved particulate respirators with faceshields.
9. Provide training to educate workers about animal allergies and steps for risk reduction.
10. Provide health monitoring and appropriate counseling and medical followup for workers who have become sensitized or have developed allergy symptoms.

These recommendations are discussed briefly in the following subsections.

Environmental Factors

Exposures to airborne allergens are affected by patterns of air flow, air filtration, bedding type, and humidity [Newman-Taylor and Gordon 1993]. Manipulating such environmental factors has successfully reduced or eliminated the risk of animal-induced allergies [Ohman 1978]. For example, patterns of room ventilation can be manipulated to reduce workplace exposures to animal allergens. Recirculated airflow should be avoided unless it is well filtered to remove animal dander and odors [Lincoln et al. 1974; Ohman 1978]. Increasing the ventilation rate and humidity decreases the amount of rat urine protein in laboratory air [Newman-Taylor and Gordon 1993; Hunskaar and Fosse 1993]. Allergen exposures are also reduced by performing animal manipulations within ventilated hoods in safety cabinets, by directing airflow away from the worker and toward the backs of the cages, and by using ventilated animal cage racks or filter-top cages [Lincoln et al. 1974].

To prevent the dispersion of allergens, street clothes should not be worn while working with animals. Potential problems for family members can be minimized by storing and laundering work clothes at the workplace [Ohman 1978; Lincoln et al. 1974].

Animal Maintenance Factors

The following animal maintenance factors influence the worker's airborne exposures to allergens:

- Animal density (the number of animals per cubic meter of room volume)
- Activity (sweeping and cleaning of cages, which can result in very high exposures)
- Cage design
- Bedding type [Eggleston and Wood 1992; Newman-Taylor and Gordon 1993; Bardana 1992]

The elimination of sawdust bedding and the use of absorbent pads as bedding material have been shown to reduce concentrations of allergens in the air [Gordon et al. 1992]. If absorbent pads are unavailable, corncob bedding is preferable to sawdust bedding [Sakaguchi et al. 1990; Edwards et al. 1983]. Vacuum cleaners or ventilation benches should always be used when cleaning cages to avoid airborne exposure.

Less Allergenic Animals

Some animals appear to produce allergic reactions in workers more frequently than others. For example, male rats are more allergenic than female rats, and rats are more allergenic than rabbits. Using a less allergenic species or sex can help reduce risks [Hunskaar and Fosse 1993; Newman-Taylor and Gordon 1993; Bardana 1992].

Skin Contact

Avoiding skin contact with animal products such as animal dander, serum, and urine has no proven benefit, but it may decrease the risk of sensitization. Gloves, lab coats, and approved particulate respirators with faceshields can all decrease skin exposure [Lincoln et al. 1974; Newman-Taylor and Gordon 1993; Bardana 1992].

Training

Workers at risk of developing animal-related asthma or allergies should be offered training that reviews the type and timing of typical symptoms, the importance of early detection and intervention, and steps

that workers and managers can take to reduce the risk of sensitization.

Medical Monitoring and Surveillance

Ongoing medical monitoring for symptoms of asthma may help protect the health of animal handlers. Medical screening with standardized questionnaires can identify workers with early symptoms of asthma [Venables et al. 1993]. Workers who report symptoms related to their jobs (sneezing, runny nose, chest tightness, wheezing, and episodes of cough or shortness of breath) should be referred for more extensive evaluation and early intervention, as appropriate. Current knowledge suggests that early termination of animal exposure for workers with asthma symptoms can reduce their risk of developing long-term symptoms. Spirometry and blood antibody testing have also been used in medical monitoring for asthma, but their exact roles are not yet defined. NIOSH has developed a surveillance case definition for occupational asthma (see Appendix). This definition may help guide medical evaluations.

Some workers with animal-related asthma and allergies may improve or completely resolve their symptoms, whereas others may have persistent symptoms. Several factors affect this outcome. Individuals are more likely to do poorly if they

- have their symptoms for a long period before the condition is recognized,
- have severe disease at diagnosis (as indicated by lung function and airway responsiveness tests), or
- have a long period of exposure before developing symptoms [Venables and Chan-Yeung 1997; Paggiaro et al. 1994].

Thus delays in recognizing the condition or stopping the exposure may result in more severe and persistent lung disease and disability [Brooks 1992].

Some employers have used preplacement examinations to identify workers at high risk for developing animal-related asthma and allergies. However, no evidence indicates that the use of a particular criterion will predict which workers will become allergic or develop animal-related asthma and allergies [Aoyama et al. 1992; Kibby et al. 1989]. Workers with a history of allergic disease are at increased risk, but this criterion is not useful for screening. For example, in one group of workers using the questionnaire as a screening tool, only 3 of 12 workers with a history of allergy developed animal-induced asthma. The screening criterion would have excluded nine workers who did not develop the problem [Kibby et al. 1989].

The presence of antibodies (IgE) in a worker's serum also fails to correlate with the presence of symptoms or the development of disease. Pre-employment screening for allergy risk factors is therefore not warranted [Aoyama et al. 1992].

Appropriate Counseling for Affected Workers

Occupational asthma symptoms must be recognized early and affected workers must be removed from exposure to allergens, since prolonged exposure can lead to irreversible disease. However, removal from exposure does not always lead to complete recovery [Venables and Chan-Yeung 1997]. Only about 50% of those with occupational asthma from various

causes recover completely after exposures are ended [Brooks 1992].

Some workers may be unwilling to leave their jobs in spite of health problems. A worker who has severe or life-threatening allergic reactions should be strongly advised to change jobs, since no prevention strategy is completely effective [Newman-Taylor and Gordon 1993].

Workers with symptoms who wish to continue working with animals should be advised of the risks. Careful medical monitoring is necessary to assure adequate control of the illness. Strict use of approved particulate respirators (as part of a formal respiratory protection program), prudent work practices, and careful housekeeping may allow a person with mild asthma to continue working [Brooks 1992]. However, the routine use of respirators is not recommended as an allergen control technique [Lincoln et al. 1974]. If extensive medical treatment (for example, the use of steroid tablets) is required, or if repeated asthma attacks occur after all steps have been taken to reduce exposure, the affected worker should leave the offending job.

Surveillance and Disease Reporting

NIOSH encourages the surveillance of occupational asthma by State health departments. To encourage uniform reporting, NIOSH recommends reporting guidelines and an asthma surveillance case definition (see Appendix). These guidelines and the case definition are recommended for public health surveillance of work-related asthma reported by physicians and other health care providers. As of 1998, three State health departments—California, Massachusetts, and Michigan—are funded by NIOSH for asthma surveillance activities.

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We greatly appreciate your assistance in protecting the lives of U.S. workers.

Linda Rosenstock, M.D., M.P.H.
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REFERENCES

Aoyama K, Ueda A, Manda F, Matsushita T, Ueda T, Yamauchi C [1992]. Allergy to laboratory animals: an epidemiological study. Br J Ind Med *49*(1):41–47.

Bardana EJ Jr. [1992]. Occupational asthma and related conditions in animal workers. In: Bardana EJ Jr., Montanaro A, O'Hollaren MT, eds. Occupational

asthma. Philadelphia, PA: Hanley & Belfus.

Bar-Sela S, Teichtahl H, Lutsky I [1984]. Occupational asthma in poultry workers. J Allergy Clin Immunol *73*(2):271–275.

Beckett WS [1994]. The epidemiology of occupational asthma. Eur Respir J *7*:161–164.

Brooks SM [1992]. Occupational and environmental asthma. In: Rom WN, ed. Environmental and occupational medicine. 2nd ed. Boston, MA: Little, Brown and Company, pp. 393–446.

Bryant DH, Boscato LM, Mboloi PN, Stuart MC [1995]. Allergy to laboratory animals among animal handlers. Med J Aust *163*(8):415–418.

Chan-Yeung M, Malo JL [1994]. Aetiological agents in occupational asthma. Eur Respir J *7*:346–371.

DeGroot AC, Messerschmidt HJM [1984]. Laboratory animal allergy. Contact Dermatitis *11*(2):121–122.

Edwards RG, Beeson MF, Dewdney JM [1983]. Laboratory animal allergy: the measurement of airborne urinary allergens and the effects of different environmental conditions. Lab Anim *17*(3):235–239.

Eggleston PA, Wood RA [1992]. Management of allergies to animals. Allergy Proc *13*(6):289–292.

Gordon S, Tee RD, Lowson D, Wallace J, Newman Taylor AJ [1992]. Reduction of airborne allergenic urinary proteins from laboratory rats. Br J Ind Med *49*(6):416–422.

Harries MG, Cromwell O [1982]. Occupational asthma caused by allergy to pigs' urine. Br Med J Clin Res *284*(6319):867.

Hollander A, Heederik D, Doekes G [1997]. Respiratory allergy to rats: exposure-response relationships in laboratory animal workers. Am J Respir Crit Care Med *155*:562–567.

Hunskaar S, Fosse RT [1993]. Allergy to laboratory mice and rats: a review of its prevention, management, and treatment. Lab Anim *27*(3):206–221.

Kibby T, Powell G, Cromer J [1989]. Allergy to laboratory animals: a prospective and cross-sectional study. J Occup Med *31*(10):842–846.

Lincoln TA, Bolton NE, Garrett AS Jr. [1974]. Occupational allergy to animal dander and sera. J Occup Med *16*(7):456–469.

Lutsky I, Baum GL, Teichtahl H, Mazar A, Aizer F, Bar-Sela S [1985]. Occupational respiratory disease in veterinarians. Ann Allergy *55*:153–156.

Newill CA, Evans III R, Khoury MJ [1986]. Preemployment screening for allergy to laboratory animals: epidemiologic evaluation of its potential usefulness. J Occup Med *28*(11):1158–1164.

Newman-Taylor AJ, Gordon S [1993]. Laboratory animal and insect allergy. In: Bernstein IL, Chan-Yeung M, Malo J-L, Bernstein DI, eds. Asthma in the workplace. New York, NY: Marcel Dekker, Inc., pp. 399–414.

NHLBI (National Heart, Lung, and Blood Institute) [1995]. Global initiative for asthma. Global strategy for asthma management and prevention. NHLBI/WHO

Workshop Report. Bethesda, MD: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, NIH Publication No. 95-3659.

Ohman JL Jr. [1978]. Allergy in man caused by exposure to mammals. J Am Vet Med Assoc *172*(1):1403–1406.

Paggiaro PL, Vagaggini B, Bacci E, Bancalari L, Carrara M, Di Franco A, et al. [1994]. Prognosis of occupational asthma. Eur Respir J *7*:761–767.

Parker JE, Petsonk EL, Weber SL [1992]. Hypersensitivity pneumonitis and organic dust toxic syndrome. Immunol and Allergy Clin of North America *12*(2):279–290.

Renström A, Maimberg P, Larsson K, Sundblad B-M [1995]. Allergic sensitization is associated with increased bronchial responsiveness: a prospective study of allergy to laboratory animals. Eur Respir J *8*:1514–1519.

Sakaguchi M, Inouye S, Miyazawa H, Kamimura H, Kimura M, Yamazaki S [1990]. Evaluation of countermeasures for reduction of mouse airborne allergens. Lab Anim Sci *40*(6):613–615.

Salvaggio JE, Taylor G, Weill H [1986]. Occupational asthma and rhinitis. In: Merchant JA, ed. Occupational respiratory diseases. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 86–102, pp. 461–477.

Venables KM, Chan-Yeung M [1997]. Occupational asthma. Lancet *349*:1465–1469.

Venables KM, Farrer N, Sharp L, Graneek BJ, Newman-Taylor AJ [1993]. Respiratory symptoms questionnaire for asthma epidemiology: validity and reproducibility. Thorax *48*(3):214–219.

Watt AD, McSharry CP [1996]. Laboratory animal allergy: anaphylaxis from a needle injury. Occup Environ Med *53*:573–574.

Zejda JE, Hurst TS, Rhodes CS, Barber EM, McDuffie HH, Dosman JA [1993]. Respiratory health of swine producers. Focus on young workers. Chest *103* (3):702–709.

Zuskin E, Kanceljak B, Stilinovic L, Schachter EN, Kopjar B [1992a]. Immunological status and respiratory findings in furriers. Am J Ind Med *21*(3):433–441.

Zuskin E, Zagar Z, Schachter EN, Mustajbegovic J, Kern J [1992b]. Respiratory symptoms and ventilatory capacity in swine confinement workers. Br J Ind Med *49*(6):435–440.

APPENDIX

NIOSH Surveillance Guidelines for State Health Departments: Occupational Asthma*,†

Reporting Guidelines

State health departments should encourage providers to report all suspected or diagnosed cases of occupational asthma. These should include persons with

A. A physician's diagnosis of asthma

AND

B. An association between symptoms of asthma and work.

State health departments should collect appropriate clinical, epidemiologic, and workplace information about reported cases to set priorities for workplace investigations.

Surveillance Case Definition

A. A physician's diagnosis of asthma

AND

B. An association between symptoms of asthma and work and any one of the following:

1. Workplace exposure to an agent or process previously associated with occupational asthma,

   OR

2. Significant work-related changes in forced expiratory volume in 1 second (FEV_1) or peak expiratory flow rate (PEFR),

   OR

3. Significant work-related changes in airway responsiveness as measured by nonspecific inhalation challenge,

   OR

4. Positive response to inhalation provocation testing with an agent to which the patient is exposed at work. Inhalation provocation testing with workplace substances is potentially dangerous and should be performed by experienced personnel in a hospital setting where resuscitation facilities are available and where frequent observations can be made over sufficient time to monitor for delayed reactions.

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* Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. In susceptible individuals, this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread but variable airflow obstruction that is often reversible, either spontaneously or with treatment. This inflammation also causes an associated increase in the existing bronchial hyperresponsiveness to a variety of stimuli [NHLBI 1995]. This hyperresponsiveness may be demonstrated by significant changes in the forced expiratory volume in 1 second (FEV_1) or peak expiratory flow rate (PEFR). Airflow changes can occur spontaneously with treatment, with a precipitating exposure, or with diagnostic maneuvers such as nonspecific inhalation challenge.

Patterns of association can vary. The following examples are patterns that may suggest an occupational etiology:

- Symptoms of asthma develop after a worker starts a new job or after new materials are introduced on a job (a substantial period of time may elapse between initial exposure and development of symptoms).
- Symptoms develop within minutes of specific activities or exposures at work.
- Delayed symptoms occur several hours after exposure, during the evenings of workdays.
- Symptoms occur less frequently or not at all on days away from work and on vacations.
- Symptoms occur more frequently on returning to work.

Work-related changes in medication requirements may have similar patterns, also suggesting an occupational etiology.

Many agents and processes have been associated with occupational asthma [Chan-Yeung and Malo 1994; Salvaggio et al. 1986], and others continue to be recognized. Changes in nonspecific bronchial hyperactivity can be measured by serial inhalation challenge testing with methacholine or histamine. Increased bronchial reactivity (manifested by reaction to lower concentrations of methacholine or histamine) following exposure and decreased bronchial reactivity after a period away from work are evidence of work-relatedness.

† Reprinted from CDC [1990], p. 43.

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