

SENSOR

Occupational Lung Disease Bulletin

Massachusetts Department of Public Health
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Dear Health Care Provider,

Welcome to the June issue of the SENSOR Occupational Lung Disease Bulletin! In this issue, we focus on the topic of bronchiolitis obliterans, a severe lung disease that can occur in workers that make or handle food flavoring. Bronchiolitis obliterans has been linked to diacetyl, an artificial butter flavoring ingredient. The illness has been called "popcorn lung disease" because of the clusters of workers in popcorn plants that have been diagnosed with the disease. However, workers in plants making food ranging from pastries and frozen food to nacho chips and candy may be exposed to the chemicals in food flavorings, and therefore may be at risk for bronchiolitis obliterans. In addition, workers who use diacetyl to produce artificial flavorings are also at risk. Please do not hesitate to contact us with any questions about this condition.

We would also like to take this opportunity to remind you to report all cases of work-related asthma to our program. Your role as reporter is instrumental in helping us to identify workplace hazards and prevent workers from becoming ill. Each report is carefully reviewed by SENSOR staff and follow-up interviews are conducted with patients. If appropriate, site visits of workplaces may be conducted with patient consent. Please let us know if there is anything we can do to facilitate reporting.

To receive your bulletin electronically, send an email message to: occupational.asthma@state.ma.us.

Sincerely,
Elise Pechter MPH, CIH

Thirty Workers in Missouri Popcorn Plant Diagnosed with Severe, Disabling Lung Disease

In August of 2000, thirty workers at a popcorn plant in Jasper, Missouri were diagnosed with bronchiolitis obliterans, an irreversible lung disease characterized by fixed airway obstruction. Most employees experienced gradually worsening symptoms of cough, shortness of breath upon exertion, and wheezing, but some workers developed severe symptoms suddenly. At least four of the workers were placed on the waiting list for lung transplants. Some workers also developed severe occupational dermatitis. Once removed from the exposure, some workers experienced a diminishment of their cough, but their shortness of breath persisted.

An investigation of the workplace revealed that diacetyl, an artificial butter flavoring ingredient, was linked with the employees' symptoms. Animal studies conducted by flavoring manufacturers as early as 1993 showed that inhalation of diacetyl resulted in severe lung injury. Additional studies completed in 2002 confirmed these findings¹. The National Institute for Occupational Safety and Health (NIOSH) issued an alert in 2004, warning of the danger posed by vapors, dusts or sprays of flavorings and recommending controls to ensure worker safety in plants using or making flavorings. NIOSH recommended substituting less hazardous flavoring ingredients as the best option for controlling health risks to workers. Additional options include local exhaust ventilation or, if possible, a closed production process where workers do not handle the flavorings. A full version of the alert is available online at www.cdc.gov/niosh/docs/2004-110. In addition to the cases in Missouri, five other case clusters of bronchiolitis obliterans have been identified across the country.

NIOSH conducted spirometry tests at the Jasper, Missouri plant of 117 of the 135 workers. The results showed that plant employees had over three times the rate of fixed airway obstruction as the national sample. The NIOSH investigation also showed that younger workers who had never smoked were five times more likely to have chronic cough and shortness of breath than the national data, and 72% of popcorn production workers reported irritation to their eyes, nose, or throat. Workers also developed doctor-diagnosed asthma or bronchitis at twice the rate of the national sample. Almost all employees had normal chest x-rays and diffusing capacity of the lung (DLCOs).

Missouri Employee Dies of Bronchiolitis Obliterans

Fifty-seven-year-old Linda Redman, one of the 30 workers who became ill after working at the Missouri popcorn plant, died on April 30, 2006 after a 10-year battle with bronchiolitis obliterans. A formerly active woman with no respiratory problems, she worked in the plant for only 18 months. She developed severe symptoms as her lung capacity decreased to 15%. Redman was confined to a wheelchair and required oxygen for the last year of her life.

¹ Hubbs, A.F., Mercer, R.R., Batelli, L. et al. 2002. Ultrastructural changes in the airways of rats inhaling butter flavoring vapors. *Toxicol. Sci.* 66:Suppl. 194.

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Two Cases of Bronchiolitis Obliterans Reported in Flavorings Manufacturing Plants in California

Case 1

A 32-year-old California man was diagnosed with bronchiolitis obliterans in 2004. He began working in a flavorings manufacturing plant in October 2001. The patient poured diacetyl and other liquid ingredients into a hole in a blender lid and mixed the ingredients to form various flavorings. He had no previous history of breathing problems. In November of 2003 he developed shortness of breath during exertion, intermittent wheezing, left-sided chest pain, and a productive cough. He visited his health care provider in December of the same year and was prescribed antibiotics and bronchodilators for bronchitis and allergic rhinitis. The patient's symptoms worsened and he stopped working in January 2004. A high resolution chest CT scan revealed cylindrical bronchiectasis in the lower lobes of the lungs. A pulmonary function test done in April 2004 showed that the patient had lost over 70% of his lung capacity (FEV1 of 1.10 liters). In October 2004, he saw an occupational pulmonologist who performed another chest CT. The test showed central peribronchial thickening with central airway dilation and mosaic attenuation throughout the lungs. The patient was diagnosed with bronchiolitis obliterans. Nineteen months after the diagnosis, the patient continued to have severe shortness of breath; he requires oxygen and is on a waiting list for a lung transplant.

Case 2

A second California report involved a 43-year-old woman who started working in a flavoring manufacturing plant in 1998. Her duties included mixing dry powders with diacetyl to make butter flavorings. In August 2005 she visited her primary care provider with symptoms of nasal congestion and was given antibiotics and antihistamines. She developed gradually worsening shortness of breath upon exertion, decreased tolerance for exercise, and nonproductive cough. In November 2005, she was referred to a pulmonary specialist who suspected that she had work-related asthma. She was treated with bronchodilators and oral corticosteroids, with no significant improvement in her symptoms. A high resolution thin-section chest CT revealed several small areas of patchy ground glass opacities throughout the lung field. The patient stopped working in December of 2005. Pulmonary function tests showed severe airway obstruction with an FEV1 of 0.55 liters (18% of the predicted value). Static lung volumes by body plethysmography were consistent with severe air trapping and diffusing capacity of the lung was normal. The diagnosis of bronchiolitis obliterans was made on the basis of fixed airway obstruction, normal diffusing capacity and CT scan findings. The patient continues to have severe shortness of breath with minimal improvement in fixed airway obstruction, despite treatment with corticosteroids.

Diagnosing Bronchiolitis Obliterans²

Bronchiolitis obliterans is an uncommon disease that is often misdiagnosed. The following information can assist in the recognition and diagnosis of bronchiolitis obliterans.

Symptoms: The most salient respiratory symptoms of bronchiolitis obliterans are cough and shortness of breath upon exertion. Symptoms typically do not improve during weekends or vacations. Symptoms tend to occur gradually and worsen over time, although severe symptoms have been known to develop suddenly. Other symptoms may include fever, night sweats, and weight loss. Bronchiolitis obliterans is often misdiagnosed as asthma, chronic bronchitis, emphysema, or pneumonia.

Occupational history: Review exposures to chemicals and symptoms experienced by other workers. Obtain Material Safety Data Sheets (MSDSs) for chemicals of interest. Diacetyl should be listed under Hazardous Ingredients, section 2 of the MSDS by the CAS number 431-03-8. You may need to contact the manufacturer for specific names of trade secret chemicals.

Medical evaluation: As demonstrated by the case studies described in this bulletin, chest x-rays and diffusing capacity of the lung (DLCOs) are usually normal, especially in early stages of the disease. Spirometry can show fixed airway obstruction and sometimes restriction. Lung volumes may show hyperinflation due to trapped air beyond obstructed airways. High resolution CT scans can also provide useful information. In some cases a lung biopsy is necessary to make a definitive diagnosis.

Reporting Bronchiolitis Obliterans

SENSOR and NIOSH are interested in identifying respiratory diseases associated with food flavorings. These illnesses may include work-related asthma and chemical pneumonitis, as well as bronchiolitis obliterans. Both work-related asthma and chemical pneumonitis are formally designated as reportable conditions in Massachusetts so it is not necessary to obtain patient consent to report these cases. Please use the enclosed reporting form to report cases to us. Because bronchiolitis obliterans itself is not specifically identified as a reportable condition, it is necessary to obtain informed consent from patients before reporting cases to our program. If a patient does not consent to reporting, you may still contact us to report the company where the condition developed without revealing the worker's name.

Work-Related Asthma Cases Reported to Massachusetts SENSOR

March 2006	April 2006	May 2006	Total (3/92 – 4/06)
4	6	2	1038

² Adapted from the Hazard Evaluation System and Information Service (HESIS) of the California Department of Public Health.

Remember, work-related asthma cases may be reported to SENSOR by phone, fax, or mail!