Prophylactic Measures

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The prevention of occupational diseases due to exposure to food allergens requires the application of classical occupational health concepts to specific occupational allergenic exposures. Two models or approaches have proven successful in many occupational settings. The first involves the concepts of primary, secondary, and tertiary prevention. Primary prevention efforts interrupt the initiation of the disease process by preventing exposure to food-related substances that can trigger occupational asthma, rhinitis, or hypersensitivity pneumonitis. Secondary prevention is the detection of diseases at an early stage before a worker would normally seek clinical care. In this asymptomatic or mildly symptomatic stage, the asthma or rhinitis may be reversible on discontinuation of exposure and more readily treated. Tertiary prevention is appropriate medical care of the diseased individuals with hope of limiting impairment and disability. Since an unknown fraction of occupational asthma patients will continue to have attacks after exposure ceases, and some chronic cases of hypersensitivity pneumonitis may have permanent damage, obviously preventive efforts should be directed at primary prevention and *not* tertiary prevention.

Although occupational asthma and other occupation-related allergic diseases represent a small fraction of all the asthma and other diseases in the United States, prevention of work-related diseases may be more feasible than that of nonoccupational diseases, because the former are caused by specific exposure that can be reduced substantially. In addition, the risk of developing disease for the highly exposed worker can be substantial.

The easiest place to practice primary prevention or elimination of exposure is when a new manufacturing process is being planned. The cost of prevention is lowest if appropriate control strategies are designed from the beginning. Another important point in implementing primary prevention is that the design of control strategies needs input from the actual employees and their immediate supervisors who will be using the equipment, so that control ideas will reflect the complex reality of actual production. The unused lifting devices (installed to prevent back disorders) that litter many assembly lines are the consequence of not involving employees in the design and installation of control strategies.

The case histories of several patients with occupational asthma identified by the National Institute of Occupational Safety and Health's (NIOSH) Health Hazard Evaluation Program illustrate the need for more effective secondary and even tertiary prevention. Fine presented two case histories from the egg production industry. (The principal investigators for these studies were Drs. Matthew London and Alexander Blair Smith.)

The first patient had been employed for less than 1 year. Her jobs had included candling and breaking eggs. She had a 13-pack-a-year smoking history and denied any personal or family history of asthma, hay fever, or eczema. By questionnaire, she stated that, during the month she was hired, she began to experience shortness of breath that she related to work and that occurred less frequently on days away from work than on work days. Approximately 5 months prior to NIOSH's survey of her workplace, she began to experience wheezing, which she did not specifically relate to workplace exposures. Nevertheless, the wheezing occurred less frequently away from work than on workdays. She had noticed daily an itchy, runny, stuffy nose and frequent sneezing at work. Her pulmonary function tests (forced spirometry) were normal. Her peak expiratory flow rate over 7 days demonstrated a clear temporal relationship

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to work. Specifically, she was exposed to egg products on 4 of 7 days and, on each of these 4 days, had greater than 20% drop in her peak expiratory flow rates during work. On 3 of 7 days, she was not exposed to egg products, and, on each of these days, the variation in her expiratory flow rate was less than 20%. In addition, on 3 of the 4 days on which she was exposed to egg products, her peak flow tracing yielded an obvious "U-shaped" pattern. She had positive skin-prick tests to factory whole egg, factory egg white, and ovalbumin.

This patient shows the need for early, aggressive identification of asthma in high-risk environments. Employees need to be educated to report symptoms and need to be surveyed or screened at frequent intervals in high-risk environments.

Some employees will not cooperate with reporting symptoms if the result (from their point of view) is an adverse effect such as being terminated or placed in a lower paying position. In fact, because of economic necessity, employees with asthma will use medication to suppress their symptoms partially and perhaps put themselves at risk for more serious consequences. The next case illustrates the potential for this type of problem.

The second patient had been employed for more than 20 years. She had never smoked cigarettes. Approximately 4 years prior to the investigators' survey, she had been told by a physician she had developed asthma. At the time of the survey, she was taking oral theophylline, a bronchodilating drug. She stated that she previously had received prednisone and albuterol by inhalation. She denied any personal history of eczema, hay fever, or other allergies. She had a family history of asthma and hay fever. By questionnaire, she reported wheezing, shortness of breath, and chest tightness that had begun approximately 1½ years before the survey. These symptoms were related to activities at work. The wheezing and chest tightness occurred less frequently on days away from work than on workdays. Simple spirometry was normal. Her peak expiratory flow rate demonstrated greater than 20% declines during 2 of 4 days when she had occupational exposure to egg products. Interestingly, these 2 days followed 3 days of no exposure to egg products. On the 3 days when she was not exposed to egg products, the variation in peak flow rates was less than 20%. She was taking oral theophylline on all days for which peak expiratory flow rate determinations were made. She had positive skin-prick tests to conalbumin, ovalbumin, ovomucoid, and lysozyme. She had positive radioallergosorbent tests to factory whole egg, factory egg yolk, conalbumin, lysozyme, and ovomucoid. As well, she had a moderately elevated total serum IgE level. The need for tertiar prevention in this case is obvious.

The second approach that is an effective way t prevent occupational disease uses monitoring to iden tify potential and actual hazardous exposures. Enviro mental monitoring, usually conducted by industri hygienists, is often the most important way of dete mining whether a potential problem is actually a haz ard. An example of effective environmental monitorin is the NIOSH investigation that established that 12% of the workers exposed to the proteolytic enzyme mea tenderizer papain in a plant preparing meat for restau rants had definite or possible occupational asthma.

The first step in environmental monitoring is a de tailed process description to identify the sources o exposure. In the NIOSH investigation, the exposure were expected to be highest in the compounding room and at the sprayer operation where the liquid tenderiz ers were applied. In this plant, the compound worker had high 8-hour exposures of 0.5 $\mu g/m^3$ to papain although they were only exposed for approximately 1 hour each day. The employees on the T-bone steak line, where liquid spice mixture was used, had exposures between 0.24 and 1.7 $\mu g/m^3$. Elsewhere in the plant the levels of exposures were substantially lower (0.00 $\mu g/m^3$).

Environmental sampling in this investigation con firmed the work processes and jobs with highest expo sure to papain but also directed attention at the existing processes that required more effective local ventilation. There is no standard for exposure to papain; however, the American Conference of Governmental Industrial Hygienists (ACGIH) has proposed a TLV of 0.06 $\mu g/m^3$ for subtilisin proteolytic enzymes derived from *Bacillus subtilis* that are used in the laundry detergent industry. (Papain exposures above 0.06 $\mu g/m^3$ were associated with the development of asthma in this investigation.)

These two health hazard evaluations underline the need for effective occupational practices emphasizing primary prevention, effective medical surveillance, and environmental monitoring where exposures to respira ble aerosols from food products occur.

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