

Evaluation Of Methods To Determine Excessive FEV1 Decline In Workers Exposed To Diacetyl-Containing Flavorings

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Rationale: Diacetyl exposure causes bronchiolitis obliterans, which can result in severe impairment within months. The American Thoracic Society (ATS) and the American College of Occupational and Environmental Medicine (ACOEM) both use criteria based on a 15% annual decline in forced expiratory volume in 1 second (FEV1) within the first year to identify clinically important decline. However, for rapidly progressive fixed obstruction, this criterion of abnormality may be too insensitive for workplace screening programs of flavoring-exposed employees. We compared these criteria with alternative methods of identifying abnormal FEV1 decline among a normative population and a microwave popcorn manufacturing workforce with diacetyl exposure.

Methods: We analyzed spirometric results from 97 workers exposed to diacetyl-containing flavoring and compared them with those of 717 workers from a normative working population. Each individual had at least two spirometric evaluations within a 13.5-month follow up period. We used four methods to determine excessive FEV1 decline, including the ATS and ACOEM criteria based on 15% decline. The other two methods used relative and absolute limits of longitudinal decline (LLDr and LLDa respectively), developed by Hnizdo et al. (Occup Environ Med. 2007;64:701-707), which identify limits of annual FEV1 decline based on precision of repeat spirometric data within the normative group. Relative risk of abnormal decline and percentile of individuals in the normative group with abnormal FEV1 decline was determined for each method of evaluation.

Results: Using the ATS and ACOEM criteria, only 1.12% of the normative working population had an abnormal decline. Using a relative or absolute lower limit of decline, 3.35% and 3.63% of the normative population had an abnormal decline respectively. The relative risk for abnormal decline among the diacetyl-exposed microwave popcorn workers compared to the normative working population was 5.5 (95% CL 2.0-15.6) using the ATS and ACOEM criterion; 4.0 (2.1-7.6) using the LLDr criterion, and 2.3 (1.1-4.9) using the LLDa criterion.

Conclusions: These results support earlier studies that ATS and ACOEM criteria may fail to identify individuals with clinically significant FEV1 decline over a short duration in workplace monitoring programs (J Occup Environ Med. 2004;46:591-595). Other methods of interpreting longitudinal screening, including LLDr and LLDa, may better approximate an appropriate lower limit of FEV1 decline in this setting. All methods of evaluating abnormal decline in serial spirometry over approximately one year identified higher relative risk of abnormal decline in individuals exposed to diacetyl compared to a normative population.

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