

Occupational Health Surveillance / Respiratory Epidemiology and Disease Section

Concurrent Session - Abstracts | IN PRESENTATION ORDER

Methylene-Diphenyl Diisocyanate (MDI) Usage, Exposure and Health Outcomes among Polyurethane Spray Foam Insulators in the Construction Industry.

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Research Purpose: Evaluate methylene-diphenyl diisocyanate (MDI) usage, exposure and health outcomes associated with polyurethane spray foam insulation in the construction industry.

Relevance: Isocyanate-containing polyurethane products, such as spray foam insulation are increasingly being used in the construction industry. MDI, the essential “cross-linker” used in generating sprayed polyurethane foam, is a well-recognized allergen and asthmogen. MDI exposures, and potential health consequences associated with applying sprayed polyurethane foam remain unclear. The industry, comprised primarily of small businesses / subcontractors that constantly change work locations, is challenging to study.

Participants: Construction workers who use isocyanate-containing products were recruited, and provided written informed consent. Workers included spray foam insulation applicators, energy auditors and general construction laborers. The study was approved by Yale University’s institutional review board, and all work was performed in accordance with Yale University’s rules regarding the ethical conduct of clinical research and protection of human rights.

Methods: A cross-sectional study design was used to collect information on current workers MDI usage and exposures. Demographic information, personal exposure to MDI, use of personal protective equipment (PPE), symptoms, and health information were collected by questionnaire. Subjects underwent spirometry in the field and donated

10cc of peripheral blood. Serum was separated from whole blood for use in ELISAs. MDI vapor levels were measured using a portable gas detector, while surface contamination was assessed using colorimetric wipes.

Analysis: Questionnaire data were coded and entered into a secure database. MDI-specific IgG and IgE end-titers were calculated from ELISAs based on MDI-albumin conjugates. Non-normally distributed data were log-transformed and significant associations between MDI-specific IgG serum levels, health outcomes and basic demographic information were determined using SAS.

Results: A total of N=94 construction workers were recruited, including 54 polyurethane spray foam insulators. PPE worn included air supply and cartridge respirators, tyvek suits, and nitrile or work gloves. Fifty-seven % of insulators had positive MDI-specific IgG serum levels (avg. end titer =1:1093) compared with 10.5% of other workers (avg. end titer=20). The prevalence of work-related asthma symptoms, skin rash and visual symptoms (blue haze) was significantly elevated among spray foam workers, compared to other construction workers. Airborne MDI vapor levels were consistently below detection, however surface contamination and self-reported skin exposure were common. Job tasks (aside from spraying), with unexpected potential for skin exposure, included cleaning equipment, trimming foam and consolidating 55-gallon drums of MDI.

Conclusions: MDI-IgG levels and work-related asthma symptoms are more common among workers who apply polyurethane spray foam insulation, compared to other construction workers.

Implications: The data highlight the potential for MDI exposure during the application of polyurethane spray foam insulation, as well as the need for more stringent industrial hygiene controls. The data also highlight the potential utility of MDI-IgG as a marker of MDI exposure.

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