

# Worker and Consumer Exposure Issues

## Concurrent Session Abstracts | IN PRESENTATION ORDER

### Occupational Exposure to Isocyanates and Use of Respiratory Protection in the Car Repair Industry; A Baseline Exposure Assessment

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**Financial disclosure:** Nothing to disclose

**Introduction:** Occupational exposure to isocyanates has been associated with the development of occupational asthma in various settings, including the car repair industry. Hardeners of polyurethane (PU) lacquers which are used in base- and topcoats generally contain hexamethylene di-isocyanate (HDI). In the Netherlands approximately 20.000 workers are potentially exposed by performing various isocyanate-related tasks, making this a potential large contributor to the burden of disease. Respiratory protective equipment (RPE) is currently one of the most important preventive measure used. This study serves as baseline measurement within an intervention study, aimed at reducing the work related exposure to isocyanates among car repair workers. The aim of this study was threefold: 1) conducting a detailed exposure assessment and determine exposure determinants, 2) evaluating the effectiveness of respiratory protection, and 3) providing input for the development of a broad intervention strategy.

**Methods:** Inhalation exposure was assessed by personal exposure sampling with midget impingers, containing di-n-butylamine (DBA) in toluene. Personal task-based inhalation samples for mixing, spraying and gun cleaning were collected among 37 workers, divided over eighteen companies during spring 2012. Samples were analyzed using the liquid chromatography tandem mass spectrometry (LC-MS/MS) technique, according to the ISO 17734 norm for DBA impinger sampling. We obtained relevant information regarding potential exposure determinants (i.e. type and location of ventilation, used products, worker orientation towards spraying object) and behavioral and organizational factors by performing a detailed walk through survey and an individual questionnaire. Descriptive statistics will report on exposure levels, stratified per task and company. Association between exposure and work practices, task time, behavioral factors (e.g. knowledge, awareness, and attitude), and organizational factors (e.g. intensity towards supporting OSH-programs) will be determined using mixed effect regression models.

The level of respiratory protection was assessed by placing cassettes, loaded with glass fiber filters impregnated with 1-(2-methoxyphenyl) piperazine (1,2-MP), both in the breathing zone outside the respirator and inside the respirator through an adapter during spraying and gun cleaning activities. These filter measurements were obtained among twenty-two subjects. Samples were analyzed using LC-MS/MS, according to the ISO 16702 norm for 1,2-MP filter sampling. Additionally, we obtained indicative information on dermal exposure by applying a questionnaire to assess dermal exposure with the so called DREAM approach.

**Results:** A dataset was collated containing 145 personal task-based samples and 56 filter measurements (28 outside and 28 inside respirator). Spray painting results in the highest exposure levels compared to mixing and gun cleaning. Both in frequency and concentration, HDI-oligomers (e.g. isocyanurate, biuret, uretidione) are the most dominant compounds compared to di-isocyanates. A full overview of the preliminary results and a first outline of the intervention strategy will be provided during the presentation.

The use of respirators seems task-dependent, where first analysis seem to indicate that the protection factor is above 90%. Final results about the possible effect of all mentioned determinants will be presented at the conference.

**Discussion:** Our analyses will provide us information about exposure determinants, respiratory protection and the possible importance of dermal exposure that will be translated into an intervention strategy. This intervention strategy will be assembled with information about the effectiveness of current control measures present in some of the work places and also additional generic knowledge on exposure management strategies. Another abstract described the development of a disease model that will eventually be used to perform health impact assessment based on the changes in exposure observed in our intervention study.

### Effectiveness of Educational and Behavioral Interventions to Reduce Isocyanate Exposure in the Auto Body Repair and Refinishing Industry: A Cluster-Randomized Controlled Trial

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**Financial disclosure:** Nothing to disclose

**Research Purpose:** To better control isocyanate exposure and prevent occupational asthma in the auto body repair and refinishing industry, improved exposure control strategies are needed. We conducted a cluster-randomized controlled trial in this industry. The main objectives were to assess the effectiveness of educational and behavioral interventions on worker knowledge, attitudes, and self-reported and observed behaviors with regard to isocyanate exposures.

**Relevance:** The study is highly relevant to the conference themes: worker exposure issues.

**Participants:** 103 workers from 14 auto body shops participated in this study with signed written informed consent. 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:** Shops with all their participating workers were randomly assigned into the intervention and control groups. The intervention group received both educational training and behavioral feedback process throughout the first 6 months. Original surveys of exposure-related knowledge and attitudes and self reported behavior were administered and actual behaviors were observed at baseline, 6, and 12 months.

**Analysis:** Data were analyzed using the 2 test and linear modeling, and statistical significance was set at  $P < 0.05$ .

**Results:** Worker knowledge and attitudes improved significantly ( $p < 0.05$ ) in the intervention group [mean change (or improvement) in score 24] compared with control group (mean change in score 4) in the 6-month period. Self-reported behavior also improved significantly ( $p < 0.05$ ) more in the intervention group (mean change in score 20) compared to the control group (mean change in score 6). Most improvements were sustained at 12 months. At baseline, knowledge and attitudes were significant predictors of self-reported behavior ( $p = 0.008$ ). In all study periods, knowledge and attitude mean score was also highly correlated with self-reported behavior. Self-reported behavior was highly associated with observed behavior. Over 87% of workers who reported using a respirator for painting were observed to use a respirator, as an example.

**Conclusions:** Educational training and behavioral feedback improve knowledge, attitudes, and self reported and observed behaviors in auto body workers exposed to isocyanates. Knowledge and attitude survey is a potentially useful tool to characterize auto body worker exposure risk and readiness for behavior change. In this setting training with behavioral feedback did not add significant benefit beyond the educational intervention.

**Implications:** This study identified effective intervention components in improving worker safety knowledge, attitudes and self-reported behaviors in the auto body repair and refinishing industry. The findings can help increase use of safe work practices.

**Funding Acknowledgement:** This study was supported by CDC/NIOSH grant R5 R01OH004246.



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APRIL 3-4, 2013

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