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ETHYLENE OXIDE AND BREAST CANCER INCIDENCE IN A COHORT STUDY OF 7576 WOMEN. *K. Steenland, E. Whelan, J. Deddens, L. Stayner, and E. Ward (National Institute for Occupational Safety and Health, Cincinnati, Ohio)

Ethylene oxide (ETO) is a sterilant gas considered to be a human carcinogen, due primarily to excess hematopoietic cancer in exposed cohorts. ETO causes mammary tumors in mice, and has been associated with breast cancer incidence in one small epidemiologic study. We have studied breast cancer incidence in a cohort of 7,576 women employed for at least one year and exposed for an average 10.7 years while working in commercial sterilization facilities. Breast cancer incidence ($n = 319$) was ascertained via interview, death certificates, cancer registries, and medical records. Interviews were obtained for 68% of the cohort. The standardized incidence ratio (SIR) for incident breast cancer in the whole cohort using external referent rates (SEER) was 0.87 (0.77, 0.97), increasing to 0.93 (0.83, 1.04) after excluding in-situ cases (6% of cases). The rate ratio for those in the top quintile of cumulative exposure, with a 15 year lag, was 1.27 (0.94, 1.69), with a positive trend ($p = 0.002$). Breast cancer incidence in the whole cohort was under-ascertained due to incomplete response and lack of complete coverage by state cancer registries. In internal nested case-control analyses of those with interviews, controlling for reproductive risk factors, a positive exposure-response was found with the log of cumulative exposure with a 15-year lag ($p = 0.0005$); the top quintile had an odds ratio of 1.87 (1.12, 3.10). Our data suggest that ETO is associated with breast cancer, but a caution is warranted due to inconsistencies in exposure-response trends and possible biases due to non-response and incomplete cancer ascertainment.

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The analysis of dose-response relationship for binary data using monotonic regression. *G. Salanti and K. Ulm (Technical University, Munich Germany)

In epidemiology the proof of a dose-response relationship is listed as one of the criteria for inferring causality and thus is an important issue in the statistical analysis. In this context we propose monotonic regression. This method has as principal characteristics: (i) the order restricted nature and (ii) the step function shape. Monotonic framework provides a trend test R_{iso} which unlike other tests is independent of score assignment. We conclude that its asymptotic distribution does not always hold, thus we apply exact methods to infer. We show that R_{iso} is more powerful than other popular trend tests. The monotonic model can become more parsimonious if we eliminate the level sets corresponding to a non significant change for the outcome. This is accomplished by a sequence of Fisher tests. Correction for multiple comparisons is made by a priori estimating the overall significance level with permutations. This model is called reduced monotonic regression. A simulation study shows that the reduced model controls successfully the trade off between model complexity and goodness of fit. The estimation of a threshold limit value (TVL) for the dose is often of interest in dose-response analysis. Monotonic regression estimates a set of candidate values, and we propose three equivalent procedures to select the actual TVL: the first applies likelihood ratio tests, the second is based on the reduced model and a third method uses a modification of the closed testing procedure. The statistical properties of these methods are described within a simulation study. An application outlines this methodology: the monotonic regression is used to assess a threshold for PNOC (particles not otherwise classified).

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A CROSS SECTIONAL ANALYSIS OF MUSCULOSKELETAL DISORDERS IN HOME HEALTHCARE WORKERS. *M. S. Thiese, K. T. Hegmann, A. Garg, J. Kapellusch, S. C. Alder, and A. Wendelboe (University of Utah, SLC, UT 84108).

The home healthcare (HHC) industry is growing rapidly and few studies have been performed analyzing worker risks for musculoskeletal disorders (MSDs). HHC Aides perform patient transfers and are considered the high exposure group. Nurses are considered an intermediate exposure group and other workers (e.g., therapists) are a low exposure group. We recruited 883 subjects in Utah, Wisconsin, Iowa and Canada from 24 agencies. The participation rate averaged >95%. The crude 1 year prevalence rate ratio (PRR) for low back pain (LBP) for Aides was 3.44 (95% Confidence Interval (CI) 2.25, 5.29) compared to the low exposure group. For Nurses the PRR was 2.09 (95% CI 1.34, 3.27). For neck pain, the PRR for Aides was 1.68 (95% CI 1.07, 2.69) and for Nurses was 1.82 (95% CI 1.14, 2.97) compared to the low exposure group. For shoulder pain PRRs for Aides and Nurses were 2.03 (95% CI 1.27, 3.32) and 1.87 (95% CI 1.14, 3.12) respectively. Logistic regression was used to adjust for age, gender, body mass index, tobacco, work-related and personal psychosocial stressors. The adjusted PRR for Aides for HHC related back pain was 3.36 (95% CI 2.18, 5.18) and for Nurses was 1.96 (95% CI 1.26, 3.06). The adjusted PRRs for HHC related neck pain were 1.74 (95% CI 1.08, 2.80) and 1.96 (95% CI 1.21, 3.20) for Aides and Nurses respectively. The adjusted PRR for HHC related shoulder pain for Aides was 1.81 (95% CI 1.12, 2.94) and for Nurses was 1.68 (95% CI 1.02, 2.75). >From these data we conclude that Aides and Nurses appear to be at increased risk for HHC related back, shoulder and neck pain, with Aides at generally higher risk.

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CANCER INCIDENCE IN A COHORT OF FLORIDA FIREFIGHTERS. *F Ma, LE Fleming, D Lee, E Trapido, M Rudolph, L Voti, and S Cobian. (University of Miami School of Medicine, Miami, Florida 33136)

To examine the cancer risks associated with firefighting in Florida, a retrospective cohort study was conducted among 35,777 males (493,532 person years) and 2,165 females (19,273 person years) certified between 1972 to 1999 in Florida to work as fulltime firefighters. Age- and gender-specific cancer incidence rates in the general Florida population were used as comparisons in calculating the standardized incidence ratios (SIR). A total of 1,032 cases of cancer among Florida firefighters (970 male and 52 female) were identified by linkage with the Florida Cancer Data System as of 12/31/1999. The overall risk of cancer among male firefighters was significantly lower relative than that of the general Florida population (age adjusted SIR = 0.84; 95% CI = 0.79, 0.90) as well as for cancers of buccal (0.67; 0.47, 0.91), stomach (0.50; 0.2, -0.90), lung (0.65; 0.54, 0.78), and brain (0.58; 0.31, 0.97). Significantly increased cancer incidence was observed among male firefighters for bladder (1.29; 1.01, 1.62), testes (1.60; 1.20, 2.09), and thyroid cancers (1.77; 1.08, 2.73). Female firefighters had significantly increased overall (1.63; 1.22, 2.14) and thyroid cancers (3.97; 1.45, 8.65) as well as Hodgkins disease (6.25; 1.26, 18.26). This study did not find evidence for an excess risk of lung or brain cancer in firefighters as documented in prior mortality studies. However, this study does suggest that a significantly increased risk of bladder cancer among male firefighters might be related to occupational exposure, rather than to usage of tobacco. This work was funded in part by a grant from the National Institute of Occupational Safety and Health (NIOSH).

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