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**The role of exposure reconstruction in occupational human health risk assessment: Current methods and a recommended framework.**

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**Abstract:** Exposure reconstruction for substances of interest to human health is a process that has been used, with various levels of sophistication, as far back as the 1930s. The importance of robust and high-quality exposure reconstruction has been recognized by many researchers. It has been noted that misclassification of reconstructed exposures is relatively common and can result in potentially significant effects on the conclusions of a human health risk assessment or epidemiology study. In this analysis, a review of the key exposure reconstruction approaches described in over 400 papers in the peer-reviewed literature is presented. These approaches have been critically evaluated and classified according to quantitative, semiquantitative, and qualitative approaches. Our analysis indicates that much can still be done to improve the overall quality and consistency of exposure reconstructions and that a systematic framework would help to standardize the exposure reconstruction process in the future. The seven recommended steps in the exposure reconstruction process include identifying the goals of the reconstruction, organizing and ranking the available data, identifying key data gaps, selecting the best information sources and methodology for the reconstruction, incorporating probabilistic methods into the reconstruction, conducting an uncertainty analysis, and validating the results of the reconstruction. Influential emerging techniques, such as Bayesian data analysis, are highlighted. Important issues that will likely influence the conduct of exposure reconstruction into the future include improving statistical analysis methods, addressing the issue of chemical mixtures, evaluating aggregate exposures, and ensuring transparency with respect to variability and uncertainty in the reconstruction effort.

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