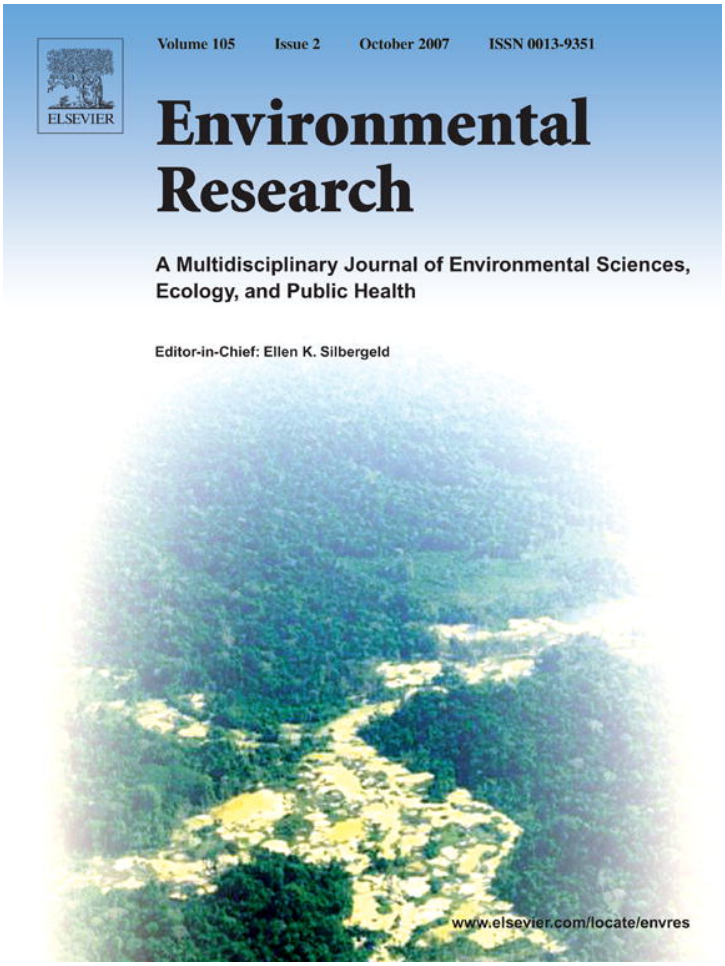

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Commentary

Pesticide exposure among farm workers

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We read with interest the recent paper on gastric cancer in farm workers (Mills and Yang, 2007). Two premises regarding pesticide exposure are evident. Since these assumptions are repeated in a series of health papers on members of the United Farm Workers union (e.g. Mills et al., 2005; Mills and Yang, 2003, 2005), we feel that additional information would be helpful to the reader. We will use the herbicide, 2,4-D, as example. However, many other registered pesticides in the United States have similar data.

The first assumption made by Mills and Yang is that inhalation of airborne pesticides is an important route of exposure in farm workers. However, since 2,4-D has a very low vapor pressure (0.0186 mPa), exposure from inhaled vapors is unlikely. Inhalation has been shown to contribute less than 2% of the cumulative exposure among 2,4-D applicators (Grover et al., 1986). Further, air concentrations of up to 20 $\mu g/m^3$ did not correspond with measurable exposure in any of the bystanders to a 2,4-D spray application (Harris et al., 1992). Thus, the likelihood of reentry workers being exposed, much less receiving a biologically active dose, via inhalation is remote.

The second assumption evident in the current study is that being present in a field treated with a given pesticide results in exposure. Again, the properties of 2,4-D reduce the prospect for significant exposure. Once on the plants or soil, 2,4-D is largely absorbed (plants) or adsorbed (soil) and degrades quickly. An extensive set of dissipation studies demonstrates very low potential for exposure to people re-entering treated areas (Wilson et al., 1997). Voluminous research demonstrates that 2,4-D is readily absorbed into plants where it is conjugated and degrades (e.g., Ashton and Crafts, 1973). Further, the authors present no data that the farm worker encountered an internal dose of pesticide or that an assumed dose was at a level sufficiently high to cause a biological and adverse health response (e.g., Munro et al., 1992; Garabrant and Philbert, 2002). Exposure studies have demonstrated extremely low exposure of 2,4-D to farmer applicators (Alexander et al., 2006; Arbuckle et al., 2002). These applicators are often at higher risk of exposure than farm workers because while mixing and loading the applicator must handle the concentrated formulation. Further, the farmer applicator is responsible for cleaning the equipment and storing the remaining concentrate.

Even so, we recognize that farm workers may inappropriately enter a treated field without the required personal protection or after insufficient elapsed time since treatment. However, the evidence for exposure is not supported by the biomonitoring work of one of the authors of the current paper. In a study of nine farm worker families, mean urinary levels of organophosphate metabolites were within the range of the 75th percentile of the US population (Mills and Zahm, 2001; CDC, 2005). The mean was also artificially high because the non-detects were excluded.

We appreciate that farm workers across the United States may experience unique difficulties due to language, cultural, and economic barriers. These barriers may place the farm worker and his/or her family at greater potential risk for health problems and pesticide exposure. We believe that reducing the risk for both is an important societal goal. However, we disagree with the conclusion of Mills and Yang in the current paper that the observed gastric cancer risk can be attributed to avoidable workplace exposure.

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Exposure cannot be avoided if the behavior leading to exposure is not defined and internal dose is not measured. Only by better understanding the correlates of exposure and the degree of internal dose, can industry, health professionals and farm worker advocates collaborate to reduce the risk of exposure.

References

Alexander, B.H., Mandel, J.S., Baker, B.A., Burns, C.J., Bartels, M.J., Acquavella, J.F., Gustin, C., 2006. Biomonitoring of 2,4-dichlorophenoxyacetic acid exposure and dose in farm families. Environ. Health Perspect. (Online December 14, 2006).

Arbuckle, T.E., Burnett, R., Cole, D., Teschke, K., Dosemeci, M., Bancej, C., Zang, J., 2002. Predictors of herbicide exposure in farm applicators. Int. Arch. Occup. Environ. Health 75 (6), 406–414.

Ashton, F.M., Crafts, A.S., 1973. Mode of Action of Herbicides. Wiley.

Centers for Disease Control and Prevention (CDC), 2005. Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention. Available: 〈http://www.cdc.gov/exposurereport/3rd/pdf/thirdreport.pdf2006〉.

Garabrant, D.H., Philbert, M.A., 2002. Review of 2,4-dichlorophenoxyacetic acid (2,4-D) epidemiology and toxicology. Crit. Rev. Toxicol. 32 (4), 233–257.

Grover, R., Cessna, A.J., Muir, N.I., Riedel, D., Franklin, C.A., Yoshida, K., 1986. Factors affecting the exposure of ground-rig applicators to 2,4-D dimethylamine salt. Arch. Environ. Contam. Toxicol. 15, 677–686.

Harris, S.A., Solomon, K.R., Stevenson, G.R., 1992. Exposure of homeowners and bystanders to 2,4-dichlorophenoxyacetic acid (2,4-D). J. Environ. Sci. Health B 27 (1), 23–38.

Mills, P.K., Yang, R.C., 2003. Prostate cancer risk in California farm workers. J. Occup. Environ. Med. 45 (3), 249–258.

Mills, P.K., Yang, R.C., 2005. Breast cancer risk in Hispanic agricultural workers in California. Int. J. Occup. Environ. Health 11, 123–131.

Mills, P.K., Yang, R.C., 2007. Agricultural exposures and gastric cancer risk in Hispanic farm workers in California. Environ. Res. doi:10.1016/j.envres.2006.11.008.

Mills, P.K., Zahm, S.H., 2001. Organophosphate pesticide residues in urine of farmworkers and their children in Fresno County, California. Am. J. Ind. Med. 40, 571–577.

Mills, P.K., Yang, R., Riordan, D., 2005. Lymphohematopoietic cancers in the United Farm Workers of America (UFW), 1988–2001. Cancer Causes Control 16, 823–830.

Munro, I.C., Carlo, G.L., Orr, J.C., Sund, K.G., Wilson, R.M., Kennepohl, E., Lynch, B.S., Jablinske, M., Lee, N.L., 1992. A comprehensive, integrated review and evaluation of the scientific evidence relating to the safety of the herbicide 2,4-D. J. Am. Coll. Toxicol. 11, 559–664.

Wilson, R.D., Geronimo, J., Armbruster, J.A., 1997. 2,4-D dissipation in field soils after applications of 2,4-D dimethylamine salt and 2,4-D 2-ethylhexyl ester. Environ. Toxicol. Chem. 16 (6), 1239–1246.