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Notes

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Re: Breast Cancer Mortality Among Female Electrical Workers in the United States

In their report, Loomis et al. (1) described an excess of female breast cancer among certain "electrical" occupations that they postulate was due to extremely low frequency electromagnetic field exposure. The greatest excess risk was found in telephone installers, repairers, and line workers who, as a group, had an adjusted odds ratio of 2.17 for mortality for breast cancer relative to other employed women. We suggest problems exist in studies that do not investigate the presence of confounding

exposures and that use job titles as surrogates for worker exposures.

Loomis et al. discount the existence of ionizing radiation exposure in these groups of workers. We have recently completed a study (2) of a telephone central office facility where workers install and maintain lines and switches for the telephone company. We found that the cross-bar switching machinery, historically used in the central office facility, contained vacuum tubes having at least 1 μCi of radium bromide and were located in racks holding 60 tubes per rack. While these cross-bar switches have been replaced by more modern equipment that do not utilize radium bromide tubes, they were still in use in at least one central office facility as late as 1992. Of importance to the issue of breast cancer was the finding that central office facility workers, who may be included in the category "installers, repairers, and line workers," may have carried these tubes in their shirt pockets. The telephone company estimated the dose rate from these tubes to be about 4 mR/h at the point of bodily contact (3). The role of this potential exposure to a well-established carcinogenic agent in the development of male and female breast cancer among central office facility workers has not yet been evaluated; however, it is not unrealistic to assume that it may be far greater than whatever cancer-inducing effect is postulated by the inhibition of melatonin from exposure to electromagnetic fields. If the category of telephone installers, repairers, and line personnel (as used by Loomis et al.) includes central office facility workers, then our findings suggest the presence of a major confounder—ionizing radiation.

For telephone pole workers, exposures to extremely low frequency electromagnetic fields may not be different from those in other occupations. Means of limited exposure levels to extremely low frequency electromagnetic fields among telephone installers, repairers, and line (pole) personnel measured by the National Institute for Occupational Safety and Health (NIOSH) investigators ranged from 1.3 to 14.8 mG. The highest value was obtained from a worker who was using a gasoline-powered drill for 2-minute in-

tervals, with levels of exposure up to 718 mG that could not be attributed to exposure to either telephone wires (carrying 48-V DC current) or overhead 60-Hz power lines. Because the workers in prior years used hand drills, the use of the gas drill is relatively new. With the exception of the use of the drill, no mean measurement of worker exposure exceeded 4.5 mG; these values are supported by a study conducted by telecommunications industry research (4). In this study, the extremely low frequency electromagnetic field exposure levels were measured in the same group of workers cited by Loomis et al. These values approximate those that NIOSH investigators have found in office settings, where sporadic exposure to electrical devices such as pencil sharpeners, computers, fans, and other equipment similarly skews the mean values upward (5,6). The overall exposure to extremely low frequency electromagnetic fields of telephone installers, repairers, and line workers may not be any higher than that of many other occupational groups of workers.

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Response

We thank Malkin and Moss for their suggestions regarding occupational exposures to agents other than electromagnetic fields in some electrical occupations. As they point out, such exposures are among the possible explanations for the excess of breast cancer we observed among these workers in our epidemiologic study (1) in which job titles were used to infer occupational exposures.

As an established carcinogen known to increase the risk of breast cancer, ionizing radiation is clearly important to consider in occupational studies of this disease. The radiation exposures that Malkin and Moss describe in telephone central office facilities are therefore of considerable interest. In our study, workers in these facilities would have been included in the category of telephone installers, repairers, and line workers for which a twofold excess of breast cancer deaths was observed. However, the extent to which radiation exposure in central office facilities could explain our findings depends on its prevalence and magnitude, which are not now known with any precision, as far as we are aware. This question can be considered in future epidemiologic and industrial hygiene studies of telephone workers, however.

Malkin and Moss also suggest that telephone line workers may not have elevated exposures to extremely low frequency electromagnetic fields on the basis of electromagnetic field-monitoring data from several industrial hygiene surveys. External data are useful in evaluating the results of our study (1), as we had no information on the level of exposure to electromagnetic fields among the workers whom we considered. Unfortunately, the data Malkin and Moss provide are difficult to interpret in this context. Their letter does not indicate the number of workers who were monitored, the duration of the measurements, or whether workers were randomly selected to be monitored. As a result, it is not clear how well these data would approximate long-term average exposures of line workers in general, the quantity that appears most likely to be implicated if electromagnetic fields are indeed carcinogenic. In addition, these results contrast quite markedly with measurements of full-shift exposures of telephone line workers (2), as well as those we have measured for randomly selected electric power company workers (3). These exposure surveys, which do indicate that line workers' long-term average exposures are substantially above background levels, should also be considered in evaluating the results of our study of breast cancer.

Malkin and Moss have provided information that may be useful in interpreting the results of our study of breast cancer among female electrical workers in light of the lack of direct data concerning the workers' level of exposure to electromagnetic fields and other agents. However, only further epidemiologic studies incorporating direct assessments of exposures to electro-

magnetic fields, other occupational agents, and the classical risk factors for breast cancer are likely to be capable of refuting or confirming the hypothesis that electromagnetic fields cause breast cancer. Perhaps Malkin's and Moss's suggestions will be helpful in planning such studies.

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Erratum: "Family History of Cancer and Colon Cancer Risk: the Utah Population Database," by M. L. Slatery, R. A. Kerber [*J Natl Cancer Inst* 86:1618-1626, 1994 (Issue 21)]. Because of a typographical error, a digit was omitted in the odds ratio in the bottom line of Table 3. The number should be 2.73 instead of .73. The Journal regrets the error.

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