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Letters to the Editor

Readers are invited to submit letters for publication in this department. Submit them to: The Editor, Journal of Occupational Medicine, PO Box 370, Bryn Mawr, PA 19010. Letters should be typewritten and double spaced and should be designated "For Publication."

Spontaneous Abortions among Semiconductor Manufacturers

To the Editor: In the recent paper by Dr. Harris Pastides et al., "Spontaneous Abortion and General Illness Symptoms among Semiconductor Manufacturers" (*J. Occup. Med.* 1988;30:543-551) I see a possible bias in the analysis, because it compares the reproductive experience of exposed women while employed with the reproductive experience of unexposed women both before and during employment. The authors explain that this was done because of the small sample size of the post-hire numbers for the unexposed group, but I suspect they may have enlarged their sample by including the wrong population.

The authors begin by calculating a spontaneous abortion (SA) ratio in a group of currently employed women, including only those pregnancies that occurred while they were exposed. Because mothers of babies tend to remove themselves selectively from the work force the resulting ratio is biased, in the sense that it is higher than what would be found in a sample of similar pregnancies in the general population. Recognizing this, the authors chose as a comparison group unexposed women from the same plant, on the reasonable assumption that their SA ratio would be subject to the same biases.

However, when they included the pre-hire experience of the unexposed women, in effect they assumed that the selection factors acting after hire were also acting before hire. The only way that this could happen, as far as I can see, is if the unexposed women did not report all of their live births that occurred before they were hired. I think this is unlikely.

The only remaining possibilities are (a) that the selection factors, ie, the selective removal of live births from the sample, are negligible in this study, in

which case there is no problem, or (b) that the selection factors are indeed present, in which case the combination of pre- and post-hire data for the unexposed will give a lower value than the data for the exposed, even in the absence of an exposure effect.

Regardless of sample size, it seems to me that the question could be resolved if we knew the post-hire SA ratio for the unexposed women. If it is low compared with the exposed group, then adding in the pre-hire experience would increase the power of the analysis without greatly changing the SA ratio for the unexposed, and we could conclude that (a) was true. On the other hand, if the post-hire SA ratio for the unexposed women is, say, about as high as for the exposed women, then (b) is true, and adding in the pre-hire experience not only increases the sample size, but changes the mean. Therefore the results may in fact be due to the use of the pre-employment experience of the unexposed women.

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The Authors Reply

Dr Gaffey suggests that a more appropriate estimate of the spontaneous abortion ratio in the nonexposed women in our study would have been achieved by including only their post-hire reproductive history. Unfortunately, this would not provide a stable estimate for this measure, because the number of post-hire pregnancies in this group was quite small ($n = 46$). This, in turn, was a result of two realities: the production facility was only about 6 years old at the time of the study, and women who held nonmanufacturing jobs at the facility were an older group, on average, than women who worked in manufacturing. Including the pre-hire reproductive history of nonexposed women not only increased the number of nonexposed pregnancies but also resulted in a comparison group whose mean age at pregnancy was quite close to that of the controls (25.5 years for photolithography, 26.0 for "diffusion," and 25.5 for nonexposed).

The potential of a bias as a result of mothers of babies removing themselves from the work force, as Dr. Gaffey suggested, was not operating in this study because we identified only eight workers who voluntarily left the facility during its short history; we successfully interviewed half of these ex-workers for our study. A few former workers terminated by the company "for cause" were not surveyed because of the greater potential for biased reporting among this group. We conclude, therefore, that Dr. Gaffey's first postulated explanation is more likely true; selection factors operating in this study did not pose a problem.

In any event, all adjustments made in order to examine the potential for a reporting bias on the part of the nonexposed group, including limiting the analysis to post-hire pregnancies, resulted in estimated spontaneous abortion ratios that were lower than those for the photolithographic and diffusion workers. The relative risks estimated in these analyses were always in the direction of an increased risk for manufacturing workers.

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