

Re: "Office employment, work with video display terminals, and course of pregnancy: reference mothers' experience from a Finnish case-referent study of birth defects" by T Nurminen, K Kurppa. *Scand J Work Environ Health* 1988;14:293—8

I would like to comment on the recent paper by Nurminen & Kurppa (*Scand J Work Environ Health* 1988;14:293—8). The population examined in this report is the reference births from a case-referent study of congenital malformations. These births were individually matched to congenital malformation births by time of birth and health care district. Since this sample was generated by individual matching to cases of congenital malformations, the findings are not generalizable to *any* population. The reason this matching was done in the original study was because health district was considered a potential confounder. That is, health district could be related to the occurrence (or diagnosis) of congenital malformations, as well as to the use of a video display terminal (VDT). These very properties make the reference sample unsuitable for further study as a cohort.

The reference sample is likely to be disproportionately weighted towards certain health care districts. Health care district could be an important uncontrolled confounder if the following two conditions hold: the outcomes under study (or their reporting) vary by district and the availability of certain types of employment (ie, VDT jobs) vary by district. Both of these conditions are likely to hold.

Another problem with this paper is the examination of the occurrence of "threatened abortion" only among women who go on to have a live birth. Without the number of exposed and unexposed women who actually had spontaneous abortions being known, this analysis gives no useful information on the possible risk of spontaneous abortion.

A final problem is found in table 3, where the total proportion of office workers who had symptoms of threatened abortion appears to be 21.3 %. In the first paragraph of the results section a rate of 8.4 % is reported. Only 9.8 % of the women who did nonoffice work reported such symptoms. This is a large difference although it could be of no consequence since the proportion of women who actually had an abortion in office and nonoffice work may be no different.

Authors' reply

On using the reference subjects' experience of a case-referent study for purposes other than the original one

The judgment made by Dr Marcus (1) that the experience of the reference mothers of our case-referent study on birth defects (2) would be unsuitable for studying pregnancy outcomes other than malformations is erroneous. We are pleased to have an opportunity to respond and to give more background information on our paper (3).

Our study was based on data collected in the Finnish Register of Congenital Malformations and supplemented with data from special interviews on the mothers' work conditions. Notification of all malformations detected during the first year of life has been compulsory in Finland since 1963. The matched-pair register was specifically designed for study purposes. The "indicator" defects of the register represent structural malformations caused by impaired organogenesis during early development, and the defects are detectable with relatively simple diagnostic measures which do not change in time and place (4). The rules of the Register stated that for each case mother a matched reference mother was to be selected whose delivery immediately preceded that of the case mother of the "indicator" defect in the same maternity welfare district (4). Finland is divided into some 1 300 districts which have a maternity center operated on a municipal basis. In 1964, the attendance rate for pregnant women was 97 %, and since 1978 it has been close to 100 % (4). We referred to these facts when we declared that all women in Finland whose pregnancy ended in a delivery of a child not stillborn or malformed in the data collection period between 1976 and 1982 were candidates for the noncase sample of our study. Thus the national Finnish population of newborns constituted the source population of our malformation study, and our series of noncases was a sample of the noncase segment of the source population. The sample was weighted by time, as is shown in table 1 of the article (3), and also by the maternity health care district to the extent that the case occurrence was determined by the area. The most influential determinant of the case occurrence — dominating the reported geographic differences in the proportions of the "indicator" defects (4) — was the very uneven distribution of the population. There is a strong concen-

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tration of inhabitants in the southern and western parts of the country. Thus the study sample became weighted to densely populated areas. (This is a property that a simple random sample of the newborns would have had.) When we examined our series of noncase newborns, we could not find any signs that the babies in the sample would somehow deviate from "normal." As we indicated in the first paragraph of the Discussion of our paper (3), the information on the course and outcome of the pregnancies of the noncase series corresponded well with data provided by other Finnish studies. (References can be found in reference 3.)

We studied the occurrence of symptoms of a threatened abortion (vaginal bleeding with or without lower abdominal pain), the occurrence of lower abdominal pain only (which we did not hold as a symptom of threatened abortion), pregnancy-induced hypertension, length of gestation, birthweight, and placental weight. Data on the symptoms of an impending early termination of pregnancy were obtained from the Register interview, which was performed at the maternity health care center by a trained midwife provided with detailed instructions on how to interview and how to fill out the questionnaire (4). The other data were obtained from the records of the maternity health care center. Because of the well-established maternal and child health care organization (introduced in 1944) and the fact that in Finland nearly all deliveries take place in hospitals with both obstetric and pediatric wards, it is unlikely that there would have been any notable variation in the diagnosing or reporting of the outcomes under study with respect to either time or place. In our data, there were no time-dependent trends in the studied outcomes. For example, the occurrence of vaginal bleeding was 9.7 % for the mothers giving birth in the 1970s (1976–1979) and 9.4 % for those giving birth in the 1980s (1980–1982). Neither was the variation of the outcomes notable by district. (See table 1.)

In our data, time was not a strong determinant of the frequency of VDT work. Among the mothers who had given birth in the 1970s, 22.7 % did VDT work in an office environment, and in the 1980s the respective percentage was 26.1. (The expansion of the use of personal computers took place later in the 1980s in Finland.) Moreover, there were no substantial differences in the proportions of women in office employment or in VDT work between the more developed southwest part of the country and the northeast. (See table 1.) (In the original case-noncase data the matching did not correlate the case and noncase series with respect to VDT use or office work. The correlation coefficient for VDT use was -0.04 , and for office work it was 0.06 .)

All VDT work mentioned in our study had taken place in an office environment. Our concern was to choose non-VDT work otherwise comparable to VDT work with respect to potential determinants of risk. Besides we aimed at contrasts in which the mothers could be expected to have similar pregnancy outcomes

if they had all been in non-VDT work and if the possible confounders were controlled in the analysis. When we used the noncase mothers' experience to study the possible relation between VDT work and the course of pregnancy, our reference to VDT work was non-VDT work in an office environment, not the total domain of nonexposure. (See reference 3, eg, tables 3 and 5.) We defined our study population by selection criteria, and we excluded subjects not belonging to the index (exposed) or reference categories (eg, all nonoffice employees when VDT work was at issue) from the contrasts. Thus we studied the relation between VDT use and outcomes of pregnancy in the limited domain of office work and singleton noncase births. All generalizations from the empirical experience gained from our study are inferred to the abstract general population, and not to any particularistic one. The principles that we have applied are compactly presented in reference 5. (Formal adjustment for a mother's residing in the southwest or northeast did not change our results, nor did the results change when a finer division of the country was used.)

We agree with Dr Marcus that a spontaneous abortion is a different end point of pregnancy than the ones we studied. Accordingly, we did not draw, and could not have drawn, any conclusions about the risk of spontaneous abortion that would be based on our results.

The proportions presented for office workers in table 3 of reference 3 were added percentages of vaginal bleeding (with or without pain) and lower abdominal pain only. When we studied the relation of VDT work to these symptoms, it was not possible to study the symptoms separately because of the small size of the group in VDT work. (This point was discussed in paragraph 3 of the Discussion of reference 3.) Dr Marcus calculated from table 3 that 21.3 % of the office workers had had either vaginal bleeding or lower abdominal pain and called these symptoms of threatened abortion. But we did not consider the occurrence of only lower abdominal pain to be an indication of this outcome. In the first paragraph of the Results it is stated that 8.4 % of the office workers had had vaginal

Table 1. Pregnancy characteristics, type of work, and mothers' areas of residence.

	South-west ^a	North-east ^a
Vaginal bleeding (%)	9.6	9.2
Pregnancy-induced hypertension (%)	7.6	8.1
Length of gestation, median (d)	281	280
Preterm birth ^b (%)	2.8	2.2
Birthweight, median (g)	3 550	3 520
Birthweight, lower quartile (g)	3 270	3 230
Office work (%)	23.9	20.2
VDT work in an office environment (%)	26.1	21.8

^a Of the mothers who had worked most of their pregnancy, 771 resided in the southwest and 273 lived in the northeast.

^b Length of gestation < 37 weeks.

bleeding (with or without pain) and that 13 % had had only lower abdominal pain. These figures add up to the figure calculated from table 3. Dr Marcus took only the first figure and was puzzled by the difference. Similarly, for the corresponding percentage for nonoffice workers, Dr Marcus took only the frequency of vaginal bleeding, which was 9.8 %, and did not count the presented percentage of lower abdominal pain only, which was 10.9 %.

Finally, we would like to point out that, whenever one conducts or evaluates an epidemiologic study, the application of the general principles of study design in the particular circumstances should be carefully examined.

References

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