Scand J Work Environ Health 1992;18(5):298-301

<https://doi.org/10.5271/sjweh.1573>

Issue date: 01 Oct 1992

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This article in PubMed: www.ncbi.nlm.nih.gov/pubmed/1439656

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Fecundity and the use of video display terminals

by Lars PA Brandt, MD,¹ Claus V Nielsen, MD²

BRANDT LPA, NIELSEN CV. Fecundity and the use of video display terminals. *Scand J Work Environ Health* 1992;18:298—301. The association between prolonged waiting time to pregnancy and the use of a video display terminal (VDT) was investigated among commercial and clerical employees in Denmark. Information on 24 352 pregnancies was obtained through register linkage with two national registers. A random sample of 2252 pregnancies was drawn, and the women were asked for information on waiting time to pregnancy, occupational exposures, and life-style factors. The overall exposure to a VDT indicated a slightly increased association with prolonged waiting time to pregnancy. The relative risks for waiting more than one year were 1.23, 0.77, and 1.61 for the women who worked with a VDT for 1—10, 11—20, and ≥ 21 h per week, respectively. Only the last relative risk was statistically significant. The results could be explained by methodological shortcomings such as recall bias or confounding by alternative factors that might affect time to pregnancy, or simply by the lack of statistical power.

Key terms: parity, reproduction, smoking, time to pregnancy.

The possible effects of the use of a video display terminal (VDT) on reproduction have been investigated during the last decade with the main focus on spontaneous abortion and congenital malformations. No scientific evidence has been found to support the early case reports on clusters of spontaneous abortions and infants with congenital malformations among women working with a VDT (1—10). Two of the studies (4, 6) reported, however, an increased risk of spontaneous abortion among women working more than 20 h per week with a VDT, but the authors explained their findings as a result of selection bias (6) or job stress (4).

Other aspects of reproduction, apart from spontaneous abortion and congenital malformations, may however be at risk. For instance, no research has been done on a possible association between the use of a VDT and reduced fecundity. Reduced fecundity indicates lack of conception or implantation or the early loss of pregnancy at any stage from gametogenesis to early unrecognized spontaneous abortion. The number of menstrual cycles (in the absence of any form of contraception) before a couple conceives (ie, time to pregnancy) can be used as an estimate of fecundity (the probability of becoming pregnant within a cycle), given regular unprotected sexual intercourse. Baird et al (11) have suggested the use of time to pregnancy as a screening tool for identifying factors that might interfere with the reproductive process. This paper

presents results on fecundity, measured as time to pregnancy, and the use of video display terminals among commercial and clerical female employees in Denmark.

Subjects and methods

The reproductive histories of 214 108 female members of the Union of Commercial and Clerical Employees in Denmark were obtained for 1983—1985 by register linkage with the Medical Birth Register and the National Register of In-patients. The women's personal identification number was used as the identification key. All of the women were between the ages of 15 and 44 years. A total of 24 352 pregnancies was registered, from which a random sample of 2252 pregnancies was drawn (9.2%). More-detailed information on data collection has been given previously (1, 2).

A questionnaire was sent in September 1987 requesting information on time to pregnancy, occupational status, job title, job stress, ergonomic factors, exposure to organic solvents, VDT use, life-style factors, and health status. The response rate was 75.5% (N = 1700). A random sample of nonrespondents was drawn (N = 196). These women were contacted by telephone and interviewed in accordance with the questionnaire.

The question relating to time to pregnancy in this study was "How long did it take you to become pregnant, that is, what was the interval between stopping contraceptive use and becoming pregnant?" The alternative responses were 0—6 months, 7—12 months, 13—24 months, 2 years or more, do not remember."

Only gainfully employed women were included in the analysis (N = 1365). The statistical analysis was based on Mantel Haenszel's stratified analysis, obtaining adjusted relative risks (12). Table 1 shows the

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potential confounders that were considered in the analysis. Information from the random sample of the nonrespondents was used to estimate the direction and magnitude of nonresponse bias from calculations of the selection odds ratios (13).

To study the potential for recall bias, another measure of work with a VDT was used, that is, occupational titles were used as a job-exposure matrix. The amount of VDT work within each job reported by women with a waiting time to pregnancy of less than seven months was used to divide the occupational titles into two groups, in which less than 5% or more than 60% of the women worked with a VDT. The relative risks for increased waiting time to pregnancy were then calculated by comparison among these two groups.

Results

There were statistically significant associations between prolonged time to pregnancy (≥ 7 months) and smoking > 10 cigarettes daily [relative risk (RR) 1.63], age 25–34 years (RR 1.61), age ≥ 35 years (RR 3.93), and one or more previous pregnancies (RR 0.55). The corresponding figures using prolonged time to pregnancy as 13 months or more were 1.75, 1.99, 7.35, and 0.39, all again statistically significant.

Table 2 shows that there was no difference in the distribution of time to pregnancy within the groups of working and nonworking women.

There was a statistically significant increased relative risk for prolonged waiting time to pregnancy (≥ 13 months) only in the subgroup with ≥ 21 h of VDT use per week [RR 1.61, 95% confidence interval (95% CI) 1.09–2.38] (table 3). The association was similar when the analysis was performed only for nulliparas (RR 1.62, 95% CI 1.04–2.53) or for women working ≥ 35 h per week (RR 1.71, 95% CI 1.15–2.57) (table 4). When using the job-exposure matrix, we found no associations between VDT work and increased time to pregnancy (table 5).

Discussion

The distribution of time to pregnancy among the study population (table 2) was rather similar to findings in

a recent Danish study among pharmacy assistants (0–6 months 78%, 7–11 months 9%, ≥ 12 months 13%) (14).

Information on exposure was not collected prior to the occurrence of the outcome (waiting time to pregnancy). The exposure information concerned early pregnancy, and therefore represents a proxy variable for the proper exposure time. The validity of the proxy variable depends on the stability of the women's jobs over a period of 6–12 months. It seems that exposure was rather stable over time in that 83% (N = 58) of the women with two pregnancies in the study period had the same exposure during both pregnancies. Still, bias due to a misclassification of exposure could exist if the women who had an increased waiting time to pregnancy tended to stop work when they became pregnant. However, no such tendency was found among the 17% of the women who had had an altered exposure from the first to the second pregnancy.

Lack of response to the questionnaire might have resulted in nonresponse bias. We studied the poten-

Table 1. Potential confounders and effect modifiers used in the multiple logistic regression analysis.

Covariable	Classification
Education	1–9 years, 10 years, > 10 years
Maternal age	< 25 years, 25–34 years, ≥ 35 years
Previous pregnancies	Yes/no
Previous deliveries	Yes/no
Previous spontaneous abortions	Yes/no
Job stress factors	Three-level job-stress index, based on 12 questions on job stressors
Ergonomic factors	Heavy lifting, yes/no Sitting more than 1 h at a time during a workday, yes/no Standing more than 1 h at a time during a workday, yes/no
Organic solvent	Exposed daily at work, yes/no
Hours of work per week	1–34 h, ≥ 35 h
Smoking	0, 1–10, ≥ 11 cigarettes a day during the first trimester
Alcohol	More than five drinks per week on the average during the first trimester, yes/no
Medicine	Daily medicine consumption during the first trimester, yes/no
Infections	Yes/no during the first trimester
Chronic diseases	Yes/no

Table 2. Distribution of time to pregnancy among working and nonworking women organized in the Union of Commercial and Clerical Employees in Denmark in 1983–1985.

Group	Time to pregnancy									
	0–6 months		7–12 months		≥ 13 months		Unknown		Total	
	N	% ^a	N	% ^a	N	% ^a	N	% ^a	N	% ^a
Working women	1012	74.1	128	9.4	188	13.8	37	2.7	1365	100
Nonworking women	251	74.9	29	8.7	49	14.6	6	1.8	335	100
Total	1263	74.3	157	9.2	237	14.0	43	2.5	1700	100

^a Percentage of all.

Table 3. Work with a video display terminal (VDT) and time to pregnancy — adjusted relative risk and 95% confidence intervals (95% CI) for prolonged waiting time to pregnancy (≥ 7 months or ≥ 13 months compared with < 7 months).

Work with VDT	Time to pregnancy					Time to pregnancy			
	0–6 months	7–12 months	≥ 13 months	Unknown	Total	≥ 7 months		≥ 13 months	
						Relative risk ^a	95% CI	Relative risk ^a	95% CI
None	650	85	114	60	909	1.00	·	1.00	·
Any hours/week	315	43	74	24	456	1.15	0.95–1.40	1.27	0.98–1.65
< 11 hours/week	184	23	40	9	256	1.11	0.87–1.42	1.23	0.89–1.71
11–20 hours/week	68	12	10	3	93	0.98	0.67–1.44	0.77	0.42–1.39
≥ 21 hours/week	60	8	22	3	93	1.32	0.97–1.82	1.61	1.09–2.38
No information on hours/week	3	—	2	9	14	·	·	·	·
Total	965	128	188	84	1365	—	·	—	·

^a Adjusted for smoking, age, and previous deliveries.**Table 4.** Work with a video display terminal (VDT) and time to pregnancy — adjusted relative risk and 95% confidence intervals (95% CI) for prolonged waiting time to pregnancy (≥ 7 months or ≥ 13 months compared with < 7 months) among nulliparas and among women working ≥ 35 h per week.

Work with VDT	Nulliparas				Women working ≥ 35 hours per week			
	≥ 7 months		≥ 13 months		≥ 7 months		≥ 13 months	
	Relative risk ^a	95% CI	Relative risk ^a	95% CI	Relative risk ^a	95% CI	Relative risk ^a	95% CI
Any hours/week	1.14	0.88–1.49	1.17	0.78–1.66	1.13	0.91–1.42	1.27	0.93–1.70
< 11 hours/week	0.98	0.69–1.38	0.91	0.57–1.45	1.06	0.80–1.41	1.13	0.77–1.56
11–20 hours/week	0.97	0.58–1.62	0.55	0.21–1.41	1.11	0.74–1.66	0.86	0.44–1.68
≥ 21 hours/week	1.30	0.88–1.91	1.62	1.04–2.53	1.28	0.91–1.80	1.71	1.15–2.57

^a Adjusted for smoking, age, and ≥ 35 hours per week, yes/no.^b Adjusted for smoking, age, and previous pregnancies.**Table 5.** Work with a video display terminal (VDT), as measured by a job-exposure matrix, and time to pregnancy — adjusted relative risk and 95% confidence intervals (95% CI) for prolonged waiting time to pregnancy (≥ 7 months or ≥ 13 months compared with < 7 months).

	Time to pregnancy			
	≥ 7 months		≥ 13 months	
	Relative risk ^a	95% CI	Relative risk ^a	95% CI
Occupational groups with less than 5% VDT work	1.00	·	1.00	·
Occupational groups with more than 60% VDT work	1.21	0.77–1.84	1.02	0.74–1.41

^a Adjusted for age and previous deliveries.

tial risk of selection bias by applying the distribution of VDT use in the random sample of nonresponders to the whole group of nonresponders. The selection probabilities for the exposed and unexposed women with a time to pregnancy of less than seven months and seven months or more were estimated, and the selection odds ratio was calculated to be 1.01, which means no selection bias due to nonresponse.

Using time to pregnancy as a measure of subfecundity means that women who did not become pregnant were not included, and the association between exposure and sterility was not investigated.

Information was not sought on the use of contraception nor on the frequency and timing of intercourse. The presence of organic disorders causing a prolonged waiting time for pregnancy, such as salpingitis and anovulation, was not known. Confounding might have been caused by such disorders.

Another source of confounding might have been an "infertile worker effect" (ie, if women with reduced fertility tend to stay in jobs and women who have proved their fertility by giving birth to children do not). However, the distribution of waiting time to pregnancy was the same among the working and nonworking women (table 2). But a selection effect could have still been operating within the group of working women if nulliparous women tended to work longer hours per week than women who already had children. The former group would have had a higher probability of high exposure, which would lead to confounding due to an association between a nulliparous state and VDT exposure. However the results for the nulliparas and

the women working ≥ 35 h per week (table 4) showed almost the same relative risks as all the working women together.

Smoking, number of previous pregnancies, and age have been found to be associated with prolonged time to pregnancy in other studies (11, 15–17). The present study found the same associations, a result suggesting a high reliability of the measure “time to pregnancy.”

The present study only showed a statistically significant association between prolonged waiting time to pregnancy (≥ 13 months) and self-reported high exposure to VDT use (≥ 21 h per week), but this finding was based on a very small number of persons. When the job-exposure matrix was used, no increased risk for prolonged time to pregnancy was found. Use of the job-exposure matrix may have introduced a non-differential misclassification of exposure, which would have led to a bias towards the null (18, 19). However, the exposure matrix was based on information from noncases and reflects true exposure. Therefore, non-differential misclassification cannot explain the finding of no effects at all (18, 19). Recall bias thus remains a possible explanation. In particular, recall bias might be expected among those waiting ≥ 13 months to conceive. Therefore, bearing the shortcomings of the study in mind, one should interpret the results with caution.

Acknowledgments

We thank Dr J Olsen, Dr NJ Secher, Dr KO Larsen, and Ms L Helsing for their scientific assistance; Ms B Waldstroem, Ms AC Dam, Ms LT Nielsen, and Ms AT Johansen for their technical and administrative support; Ms H Brandt, Ms H Bräuner, Ms K Johansen, and Ms H Nicolaisen for performing the telephone interviews; and finally The Union of Commercial and Clerical Employers in Denmark for participating in the study.

The study was financed by the Occupational Medical Research Fund in Aarhus, the Medical Research Fund, and the Health Fund.

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Received for publication: 20 December 1991