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Menstrual-cycle characteristics and work conditions of workers in poultry slaughterhouses and canneries

by Karen Messing, PhD,¹ Marie-Josèphe Saurel-Cubizolles, PhD,² Madeleine Bourguine,² Monique Kaminski²

MESSING K, SAUREL-CUBIZOLLES M-J, BOURGINE M, KAMINSKI M. Menstrual-cycle characteristics and work conditions of workers in poultry slaughterhouses and canneries. *Scand J Work Environ Health* 1992;18:302-9. The food and agriculture industry employs 14.6% of the female industrial work force in France. Workers are exposed to a variety of environmental and organizational constraints (eg, irregular schedules, cold, uncomfortable postures, repetitive movements). In 1987-1988 a medical examination and questionnaire were administered to 726 workers with menstrual periods in 17 poultry slaughterhouses and six canning factories. Anomalies (irregular cycles, amenorrhea, long cycles) during the previous year were associated with work conditions. After adjustment for relevant nonoccupational variables, irregular cycles were significantly related to schedule variability and cold exposure, amenorrhea was associated with cold exposure, and long cycles with schedule variability. Other parameters such as repetitive work, standing posture, lifting weights, job satisfaction, and hours of domestic work were not associated with cycle anomalies. Cycle anomalies may be a useful indicator of occupational effects on female reproduction, analogous to the use of sperm parameters to warn of effects on male workers.

Key terms: amenorrhea, cold exposure, epidemiologic study, menstrual disorders, nonoccupational factors, occupation, repetitive work, tobacco use.

The food and agriculture industry employs 14.6% of the female industrial work force in France (1). Because of variations in supply and demand, many of these workers have very irregular schedules. Hours of starting and ending work may vary from day to day in an unpredictable way, as does the length of the workday and even the work week. There are peak periods which may last several weeks during which hours may be even more irregular. This work environment also involves other stressors. Temperatures can be cold, especially in slaughterhouses, where temperatures in some areas may go below freezing. Many workers do their jobs standing without moving, on assembly lines, doing repetitive manipulations (2, 3).

Although it has been shown that men and women assigned to the same tasks in this industry report similar symptom profiles (4), female workers in poultry slaughterhouses are exposed to some risk factors different from those of men. They tend to be concentrated in certain tasks, most often toward the middle of the processing operation (2). Many more women were as-

signed to eviscerating, weighing, cooking, and preparing chickens. While more men lift heavy weights, women more often do repetitive, monotonous tasks, work on the assembly line, and are exposed to cold. In addition the irregularly paid work schedules of most women must be juggled with domestic responsibilities, which add many hours to the work week.

In the context of the current interest in the effects of employment on reproduction (5, 6), the effects of work in this industry on parameters involved with the menstrual cycle should be examined. These parameters may constitute an indicator of the effects of work conditions on the reproductive health of women. Disorders of the menstrual cycle have been explored in relation to occupational exposures to synthetic hormones (7, 8), organic solvents (9), carbon disulfide (10), and night work (11), although confounding factors were not examined in these studies. Amenorrhea has been associated with strenuous jobs, such as being an athlete (12) or ballet dancer (13), but not with styrene exposure (14). No occupational variables have been considered in relation to cycle length, although exercise has been associated with long cycles among college students (15). Confounding factors have not been controlled for in previous studies of nonchemical exposures and cycle anomalies.

In 1987-1988 a medical examination and questionnaire were administered to French workers in poultry slaughterhouses and canning factories. The present pa-

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per reports associations between cycle anomalies and various work conditions among women in this group.

Subjects and methods

Study population

The study was carried out in 1987–1988 in 17 poultry slaughterhouses and six canning factories in western France. The places of work were selected so as to include a diversity of subregions and factory sizes. The study population included all workers employed on 1 January 1987, administrative staff excluded. In factories employing fewer than 200 workers, all such employees were included in the sample. In the larger factories, a sample of one-half or one-third (in the largest factories) was randomly selected. This procedure yielded 1686 workers. There were 993 women, of whom 112 were not investigated due to sick leave (19 women), maternity or parental leave (51 women), lack of time of the physician (5 women), resignation (17 women), firing (2 women), retirement (3 women), refusal to participate (3 women), or other or unknown reasons (12

known). The remaining 881 women were interviewed and examined. Of these, 87 were eliminated because they reported having reached menopause, 62 because they were currently pregnant or reported having been pregnant during the current year, two because they had had hysterectomies, and four because information was not available on one or more of the parameters under study. Data on menstrual cycle were available for 726 women who had menstrual periods.

Women taking oral contraceptives constituted 34% of the sample. Their cycles were, as expected, much more regular than those of the other women. They were therefore excluded from the sample, the result being a population skewed towards older workers who were somewhat heavier, whose blood pressure was higher, and who smoked less. (See table 1.)

Instruments used for the data collection

Data were collected at the annual consultation with the occupational health physician (mandatory in France). The employees filled out a self-administered questionnaire on work conditions, social and demographic

Table 1. Population characteristics according to use of oral contraceptives.

Characteristic	Women not taking oral contraceptives			Women taking oral contraceptives	
	N	%		N	%
Age					
<25 years	37	7.8		42	16.9
25–39 years	321	67.9		191	76.7
≥40 years	115	24.3		16	6.4
P-value ^a			<0.001		
Type of factory					
Slaughterhouse	347	73.0		179	71.9
Cannery	128	27.0		70	28.1
P-value ^a			NS		
Size of factory					
<50 employees	28	5.9		17	6.8
50–199 employees	237	49.9		116	46.6
≥200 employees	210	44.2		116	46.6
P-value ^a			NS		
Parity					
No children	123	26.0		52	20.9
1–2 children	248	52.3		142	57.0
≥3 children	103	21.7		55	22.1
P-value ^a			NS		
Body mass index (weight · height ⁻²)					
≤10th percentile	47	10.0		20	8.0
11–89th percentile	367	77.9		211	84.7
≥90th percentile	57	12.1		18	7.2
P-value ^a			0.070		
Diastolic blood pressure ^b					
<60 mm Hg	229	48.8		158	65.6
60–89 mm Hg	186	39.7		69	28.6
≥90 mm Hg	54	11.5		14	5.8
P-value ^a			<0.001		
Tobacco consumption					
Nonsmoker or ex-smoker	376	79.3		158	63.4
1–9 cigarettes/d	64	13.5		58	23.3
≥10 cigarettes/d	34	7.2		33	13.2
P-value ^a			<0.001		

^a Chi-square test for association between oral contraceptive use and characteristic.

^b 1 mm Hg ≈ 133.322 Pa.

characteristics, and living conditions. The responses to this questionnaire were gone over with the physician. Further details on work conditions were obtained by interview, and a medical questionnaire covering symptoms, health status, and use of health services was completed by the physician.

The medical questionnaire included a list of questions on the menstrual cycle and contraceptive use. Cycle irregularity was scored as positive if the woman reported having irregular cycles during the year prior to the examination, with a difference of at least 7 d between the length of the shortest and longest cycles. Amenorrhea was scored as positive if the women answered yes to the question "During the past year have you had a period of several months during which you did not menstruate (pregnancy excluded)?" Cycle length was rated as long if the woman reported a regular cycle of more than 32 d or an irregular cycle with the average of the lengths of the shortest and longest cycles greater than 32 d. Short cycles (<23 d) were not related to any work conditions (or confounding factors), and the 17 workers reporting short cycles were therefore added to those with normal cycles in the analysis of long cycles. These lengths were chosen because they represented two standard deviations around the mean of 28 d found for those with regular cycles.

Potential risk factors considered for this study included both nonoccupational characteristics of the employees and characteristics of their work conditions. Nonoccupational characteristics included the following personal characteristics for which an association with cycle irregularity or infertility has been established or suspected (14–17): contraceptive use (oral contraceptives or intrauterine device or other), age (<25, 25–39, and ≥40 years), body mass index, defined as weight divided by height squared (≤10th percentile, 11–89th percentiles, and ≥90th percentile), diastolic blood pressure [≤60, 61–89, and ≥90 mm Hg (1 mm Hg ≈ 133.322 Pa)], tobacco use (nonsmoker or ex-smoker, <10 cigarettes a day, ≥10 cigarettes a day), parity (nulliparous or ≥1 births).

The work conditions analyzed covered a large number of questions on scheduling. Workers were asked whether they always began (or ended) work at the same time, their usual hour of beginning (ending) work, and

their earliest and latest hour of beginning (ending) work. In addition a variety of questions on the following aspects of work were included (yes/no unless otherwise specified): repetitive work, cold exposure, temperatures varying or not varying during the day and over the year, assembly-line work, difficulties in keeping up with the pace of the assembly line, heavy lifting, standing position, moving in place, general job satisfaction, length of domestic work week (hours). The domestic work week was analyzed as a dichotomous variable (<20 versus ≥20 hours a week). This break point split the population in half, as in a previous study, in which domestic work requiring more than 20 h a week was associated with health problems among full-time hospital workers (18). The reference period for all of the questions was the year preceding the interview.

Data analysis

In the first stage, cycle characteristics were studied in relation to each of the nonoccupational and occupational characteristics, with the use of the chi-square test or Fisher's exact test, as appropriate. Since the size of the sample did not permit all of the work conditions to be entered into the logistic regression, in a second stage, occupational characteristics associated at $P < 0.1$ with cycle anomalies were grouped into the two classes of schedule variability and temperature exposures. (No other work conditions were associated with cycle anomalies.) Multiple logistic regressions were carried out to estimate the role of representative members of each class of work condition, nonoccupational characteristics which had been related in the crude analysis to at least one indicator of menstrual disorders being controlled for. The numbers varied slightly according to the characteristics because of missing data. Logistic regressions were done for all of the subjects for whom all of the variables included in the model were available.

The tables show the adjusted odds ratios and 95% confidence intervals. It should be noted that the odds ratios roughly approximate the relative risk in our study when the they are around two, even though the prevalences of cycle anomalies were high. The analysis was carried out with SAS (statistical analysis system) and BMDP (biomedical data package) software at the INSERM computer center, "SC5."

Results

Table 2 shows the menstrual cycle characteristics for the final study population of women with menstrual periods. The characteristics irregular cycles, amenorrhea, and long cycles cannot be regarded as independent: 58% of amenorrheics and 84% of those with long

Table 2. Prevalence of cycle anomalies among the final study population.

Anomaly	N	%
Irregular cycles		
No	404	85.1
Yes	71	14.9
Amenorrhea		
No	415	90.0
Yes	46	10.0
Long cycle		
≥33 d	430	93.9
<33 d	28	6.1

cycles described themselves as having irregular cycles, and 51% of the amenorrheics reported long cycles.

Menstrual cycle and nonoccupational characteristics

Tobacco use appeared to be associated with irregular cycles and long cycles, but not with amenorrhea (table 3). The relationship between tobacco use and irregular or long cycles, remained significant at $P < 0.10$ after adjustment for the body mass index. Use of an intrauterine device was associated negatively with irregular cycles and amenorrhea. Nulliparity and age of less than 25 years or greater than 40 years were associated with amenorrhea. It should be noted that these associations may be complex since anomalous cycle characteristics can be associated with difficulties in having children, which may lead to the abandoning of contraception.

Menstrual cycle and occupational characteristics

Slaughterhouse versus cannery. Irregular cycles and amenorrhea were more prevalent among the slaugh-

terhouse workers (17 and 12%, respectively) than among the cannery workers [10 ($P = 0.06$) and 5 ($P < 0.02$)%, respectively]. It should be noted that 96% of the slaughterhouse workers, but only 57% of the cannery workers consistently worked at temperatures below 18°C. However, variable temperatures were more prevalent in the canneries. The cannery workers' schedules were more regular than the slaughterhouse workers' for all of the measures used in the study.

Schedule variability. One-third of the workers had days when their work began at irregular times, over half had days when their work ended at unpredictable times (table 4), and the vast majority did not know their schedule for the day when they arrived at work (not shown). Even outside of the seasonal peak periods, work weeks were irregular for 30% of the workers.

Overall, irregular cycles, periods of amenorrhea, and long cycles were associated with most schedule variability (table 4). One exception should be noted. Regular cycles were found more frequently among those

Table 3. Prevalence of cycle anomalies by nonoccupational characteristics of the final study population.

Characteristic	Irregular cycles		Amenorrhea		Cycles ≥ 33 d	
	N	%	N	%	N	%
Age						
< 25 years	9	24.3	6	16.2	13	8.3
25–39 years	42	13.0	22	7.1	18	5.8
≥ 40 years	18	15.8	17	15.2	7	6.3
P-value ^a		NS		0.018		NS
Living partner						
Yes	54	15.0	33	9.4	24	6.8
No	14	13.6	11	11.0	4	4.1
P-value ^a		NS		NS		NS
Parity						
No children	18	14.8	20	16.5	8	6.8
One or more children	53	15.1	25	7.4	19	5.5
P-value ^a		NS		0.004		NS
Intrauterine device						
Yes	9	8.8	3	3.0	5	5.0
No	61	16.4	43	11.9	23	6.4
P-value ^a		0.055		0.009		NS
Body mass index (weight $\cdot$ height ⁻²)						
≤ 10 th percentile	11	22.9	2	4.4	2	4.6
11–89th percentile	54	14.7	35	9.9	25	6.9
> 90 th percentile	6	10.7	9	16.1	1	1.8
P-value ^a		NS		NS		NS
Diastolic blood pressure ^b						
< 60 mm Hg	32	13.8	16	7.2	13	5.7
60–89 mm Hg	30	16.3	22	12.2	13	7.4
≥ 90 mm Hg	8	14.8	6	11.3	1	1.9
P-value ^a		NS		NS		NS
Tobacco consumption						
Nonsmoker or ex-smoker	52	13.8	39	10.7	20	5.5
1–9 cigarettes/d	9	13.8	4	6.4	3	4.8
≥ 10 cigarettes/d	10	29.4	3	8.8	5	14.7
P-value ^a		0.049		NS		0.088

^a Chi-square test for association between cycle anomaly and individual schedule characteristic.

^b 1 mm Hg $\approx$ 133.322 Pa.

Table 4. Prevalence of cycle anomalies and schedule variability among the final study population. (OR = odds ratio, 95 % CI = 95 % confidence interval)

Type of schedule variability	Overall percent	Irregular cycles				Amenorrhea				Cycles ≥ 33 d			
		N	%	OR	95% CI	N	%	OR	95% CI	N	%	OR	95% CI
Variable beginning				1.9	1.2–3.3			1.8	1.0–3.4			2.2	1.0–4.7
Yes	30	30	21.4			19	14.2			13	9.6		
No	70	41	12.3			27	8.3			15	4.6		
Variable ending				2.0	1.1–3.5			1.6	0.8–3.2			3.9	1.3–11.4
Yes	62	53	18.1			33	11.6			24	8.4		
No	38	18	10.0			13	7.4			4	2.3		
Variable hours/week ^a				1.7	1.0–2.8			1.8	0.9–3.3			2.6	1.2–5.6
Yes	30	28	19.6			19	13.6			14	9.9		
No	70	42	12.7			26	8.2			13	4.1		
Two shifts				0.4	0.2–1.1			0.5	0.2–1.5			0.7	0.2–2.4
Yes	14	5	7.5			4	6.0			3	4.5		
No	86	66	16.2			42	10.7			25	6.3		

^a Outside seasonal peak periods.**Table 5.** Prevalence of cycle anomalies and microclimate among the final study population. (OR = odds ratio, 95% CI = 95% confidence interval)

Microclimate characteristic	Overall percent	Irregular cycles				Amenorrhea				Cycles ≥ 33 d			
		N	%	OR	95% CI	N	%	OR	95% CI	N	%	OR	95% CI
Uncomfortably cold				1.7	1.0–3.0			2.1	1.1–4.3			0.9	0.4–2.0
Yes	57	47	17.6			32	12.4			14	5.5		
No	43	22	11.1			12	6.2			12	6.1		
Reported temperature				1.7	0.9–3.1			2.3	1.1–4.9			1.2	0.5–3.3
$< 9^{\circ}\text{C}$	49	31	17.5			22	13.1			11	6.4		
$\geq 9^{\circ}\text{C}$	51	20	11.0			11	6.2			9	5.1		
Temperature described as variable				1.8	1.1–3.0			1.1	0.6–2.0			0.8	0.4–1.9
Yes	37	34	19.9			18	10.8			19	6.6		
No	63	35	12.0			28	10.0			9	5.5		

Table 6. Prevalence of cycle anomalies and various work characteristics among the final study population. (OR = odds ratio, 95% CI = 95% confidence interval)

Work characteristic	Overall percent	Irregular cycles				Amenorrhea				Cycles ≥ 33 d			
		N	%	OR	95% CI	N	%	OR	95% CI	N	%	OR	95% CI
Standing position				0.9	0.5–1.6			0.9	0.5–1.8			0.5	0.2–1.2
Yes	69	47	14.5			31	9.8			15	4.7		
No	31	23	15.5			15	10.6			12	8.4		
Assembly line				1.0	0.6–1.7			0.8	0.4–1.6			0.7	0.3–1.4
Yes	63	45	15.1			27	9.4			15	5.2		
No	37	26	15.2			19	11.1			13	7.7		
Handling weights regularly				1.5	0.6–3.6			0.9	0.3–2.9			1.0	0.2–4.4
Yes	7	7	20.6			3	8.8			2	6.1		
No	93	64	14.6			43	10.1			26	6.1		
Overall job satisfaction				1.2	0.7–2.5			1.1	0.5–2.5			1.7	0.7–5.0
No	17	14	17.7			8	10.4			7	9.1		
Yes	83	57	14.5			36	9.4			21	5.5		
Household tasks				1.0	0.6–1.8			0.9	0.5–1.8			1.4	0.6–3.3
≥ 20 h/week	50	30	15.2			19	10.0			14	7.2		
< 20 h/week	50	29	14.7			20	10.4			10	5.2		

working on a two-shift schedule (changing from the morning to the afternoon shift on a weekly basis) and among those taking meals at irregular times on work-

days (not shown). These two work conditions were associated positively with each other and negatively with the other schedule variability characteristics.

Table 7. Multiple logistic regression models for associations between occupational and nonoccupational variables and menstrual cycle anomalies among the final study population. (95 % CI = 95 % confidence interval)

	Irregular cycles ^a		Amenorrhea ^a		Cycles ≥ 33 d ^a	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Variable beginning of workday	2.0	1.2–3.6	1.7	0.9–3.4	2.4	1.0–5.5
Uncomfortably cold	1.5	0.8–2.6	2.8	1.3–5.9	1.0	0.4–2.4
Variable temperature	1.8	1.0–3.2	1.1	0.6–2.2	0.9	0.4–2.2
1–10 cigarettes/d ^b	0.9	0.4–2.2	0.3	0.1–1.3	1.1	0.3–4.0
>10 cigarettes/d	2.7	1.1–6.7	0.7	0.1–3.3	4.1	1.3–13.4
Intrauterine device	0.5	0.2–1.0	0.4	0.1–1.4	0.6	0.2–2.1
Parity >0	1.3	0.7–2.6	0.4	0.2–0.9	0.8	0.3–2.3
Age ^c						
25–39 years	0.6	0.2–1.6	0.6	0.2–1.8	0.8	0.2–3.6
≥ 40 years	0.7	0.2–2.1	1.5	0.4–5.2	1.1	0.2–5.9

^a Number of women: irregular cycles = 448, amenorrhea = 437, cycles ≥ 33 d = 437.

^b Compared with nonsmoker or ex-smoker.

^c Compared with age <25 years.

Microclimate. In general irregular cycles and amenorrhea were associated with cold temperatures, whereas long cycles were not. Temperature variability was associated with irregular cycles (table 5).

Other work conditions. No associations were shown between any cycle anomalies and the domestic and salaried work conditions studied (table 6), nor between cycle anomalies and variables such as those related to work speed or repetitive work (not shown).

The multiple logistic regression models for cycle anomalies are shown in table 7. In general the confidence intervals were wider for amenorrhea and long cycles than for irregular cycles, due to the smaller numbers. Several tendencies could be noted. Schedule and temperature variability were independently associated with cycle irregularity; these variables did not interact (data not shown). Cold temperatures were associated with amenorrhea, and schedule variability was related to long cycles.

Discussion

This analysis has shown that cycle anomalies such as irregular cycles, amenorrhea, and long cycles were related to characteristics of work, such as cold exposure and schedule variability, in poultry slaughterhouses. This analysis was conducted on a sample of 475 women after the exclusion of those taking oral contraceptives. With this sample size, the power of the study was reasonably good for work conditions with a high frequency. For example, 635 of the women worked on an assembly line; the power was thus 95 or 69%, respectively, for detecting a twofold increase in the risk of irregular cycles or long cycles. On the average, the work conditions considered in this study concerned more than 30% of the women, and therefore a good

probability of detecting differences in cycle regularity was ensured. On the other hand, results concerning rarer conditions, such as handling weights, should be regarded with caution.

Possible bias

Since data on occupational factors and menstrual cycle characteristics were collected retrospectively, we cannot entirely exclude the possibility of recall or selection bias. Selection bias was unlikely, however, since data were collected during the annual visit with the occupational health physician. This visit is mandatory, and there is no reason to suppose that women with menstrual disorders were examined more or less often than other women. Recall bias also appears to us to be improbable because neither the respondents nor the occupational health physicians should have been influenced by previous studies, since little information has been available on the effects of work conditions on the menstrual cycle.

Prevalence of cycle irregularity

The prevalence of cycle irregularity over the previous year in this sample was similar to that found (with no reference period given) among unselected populations of Australian women (19), although lower than that found among day workers in Japanese hospitals (11). We were unable to compare the prevalence of amenorrhea or long cycles by our definition, since the existing studies used much younger populations, such as college students, or used more extreme definitions of amenorrhea and long cycles (15, 16). In order to look at effects in small groups of workers with relatively similar conditions, we used subclinical definitions of amenorrhea and long cycles.

Schedule variability and cycle anomalies

Variable schedules were associated with cycle anomalies in this population of menstruating slaughterhouse and cannery workers. This result is consistent with that obtained for hospital workers in Japan (11). An effect of schedule variability on reproduction is borne out by the association of irregular and inconvenient work schedules with adverse pregnancy outcome in a Swedish study of hospital workers (20).

It is interesting that work in alternating morning and afternoon 8-h shifts did not follow the pattern shown by less formal irregular work patterns. Nurminen (21) showed that shift workers had about a 1.5-fold risk of menstrual irregularity compared with nonshift workers. However, our study samples had important differences. Her sample was composed of workers from a variety of sectors of the economy, and one-fourth of those assigned to multiple shifts were in manufacturing and related occupations. Our sample was homogeneous since all of the women were manual workers in slaughterhouses or canneries and none of them were assigned to night shifts. In addition the shiftworkers in our sample were not being compared with workers assigned to a regular, 8-h day, but with those working irregular hours. Women working two shifts had more regular hours of beginning and ending the workday than the women in nonshift work. Thus regular predictable schedule variations do not seem to affect hormonal cycling in the same way as irregular schedules.

Cold temperatures

Cold temperature was associated with irregular cycles and amenorrhea. Variations in temperature were associated with irregular cycles. It is interesting to speculate on the possibility that temperature changes may be involved in the control of both reproductive and circadian cycles. An association between cold and amenorrhea is supported by a study showing amenorrheic women to be less cold sensitive than eumenorrheic women because of hormonal interactions with the thermoregulatory system (22). Cold exposure in Quebec poultry slaughterhouses was recently shown to be associated with increased dysmenorrhea, another finding suggesting a relationship between cold and hormonal levels (23).

Type of factory

Being employed in a slaughterhouse (as opposed to a cannery) was associated with irregular cycles and with periods of amenorrhea. However, the slaughterhouses and canneries differed in too many ways for it to be appropriate to include factory type in the logistic regression. Irregular cycles were not associated with being uncomfortably cold within slaughterhouses, where 96% of the workers were exposed to tempera-

tures of less than 18°C. Irregular cycles were associated with schedule variability to an equal extent in the canneries and the slaughterhouses, although such schedules were much more prevalent among the slaughterhouse workers.

Tobacco use

Use of tobacco was associated with a twofold increase in the odds ratio for irregular cycles, long cycles, and amenorrhea, although the results for amenorrhea were significant after control for all other factors. Tobacco use has been related to early menopause and other reproductive problems (17, 24). In our study, the association between smoking and cycle anomalies was not totally mediated through low body weight, as has been suggested by others (25), since the association persisted after control for body weight.

Biological indicators of female reproductive problems

For male workers, sperm samples provide a readily available means of monitoring current reproductive health (26–28). No noninvasive technique exists for sampling ova, and pregnancies are a relatively rare event, whose monitoring may be complicated by an “infertile worker effect” (29). It is possible that cycle anomalies could be a candidate for biological indicators of a potential for some reproductive problems of occupational origin, particularly those related to hormonal status. This study purposely chose indicators of low severity, at a level not necessarily pathological. Thus their prevalence was sufficiently high to permit associations to be found with occupational variables within a single workplace. It will be important to test the feasibility of applying methods which determine the regularity of the menstrual cycle and other parameters with somewhat more precision, such as personal calendars, to the workplace (30). These indicators may be useful in occupational health research in view of the difficulties of predicting health problems for small populations (31).

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