Rotating night shift work and physical activity of nurses and midwives in the cross-sectional study in Łódź, Poland

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ShiftAbstract

Shift work have been thought to restrict participation in leisure time activities, but the knowledge about physical activity in rotating night shift nurses has been limited so far. We investigated the associations between the rotating night shift work and physical activity using data from a cross sectional study among nurses and midwives.

This study included 354 nurses and midwives (aged 40-60) currently working rotating night shifts and 371 ones working days only. The information on the work characteristics and potential covariates was collected via a personal interview. Weight and height were measured and BMI was calculated. Physical activity was assessed according to the international questionnaire on physical activity – IPAQ, and four domains: leisure time, occupational, transport related and household were analyzed. Women who reported none leisure time activity were defined as recreationally "inactive". The associations were examined with multiple linear or logistic regression models adjusted for age, season of the year, number of full term births, marital status and BMI.

Total and occupational physical activity was significantly higher among nurses working rotating night shifts. However, leisure time activity was significantly affected among rotating night shift nurses and midwives, compared to women working during the days only, with increased odds ratio for recreational "inactivity" (OR=1.57, 95%CI:1.11-2.20).

Rotating night shift work among nurses and midwives is associated with higher occupational physical activity but lower leisure time activity. Initiatives supported exercising among night shift workers are recommended.

Introduction:

Night shift work has been linked to some chronic diseases including cardiovascular, metabolic diseases and cancer (IARC, 2010; Brudnowska & Peplonska, 2011; Wang et al., 2011). These diseases have multifactorial etiology and several modifiable factors may play a role in their development and prevention. Among these factors physical activity has an established role in prevention of atherosclerotic heart disease (Sattelmair et al., 2011), type 2 diabetes (Bassuk & Manson, 2005), colon (Wolin et al., 2009) and breast cancer (Friedenreich, 2011). The underlying biological mechanisms have been partially explained, with well-known role of physical activity for energy expenditure and weight control. A number of physiological improvements, for example in lipid lipoprotein profiles, blood pressure, glucose metabolism and also psychological well-being (reduced stress, anxiety and depression) have been shown to result from regular exercising (Warburton et al., 2006).

Physical activity changes over women's life, and largely depends on family and work-related responsibilities. Long working hours and shift work have been thought to restrict participation in leisure time activities, especially in team sports or group activities(Atkinson et al., 2008). It has been also suggested that night workers had more difficulty maintaining physical fitness than other groups of workers (Lipovcan et al., 2004). The knowledge on physical activity in rotating night shift nurses has been limited so far, with only one epidemiological analysis focusing particularly on this issue (Kivimaki et al., 2001). The study in Finnish nurses found that the odds ratio of sedentary lifestyle was by 31% increased,

although insignificantly, in nurses who always worked some form of shift work schedules, compared to nurses who had never done shift work (Kivimaki et al., 2001).

Owing to the beneficial role of physical activity for health and paucity of the epidemiological evidence in the topic of physical activity among shift workers we used the data from a cross-sectional study of nurses and midwives to examine this understudied topic. We investigated the associations between the rotating night shift work and specific categories of physical activity (occupational and non occupational).

Methods

This cross-sectional study included nurses and midwives registered at the Local Registry of the Chamber of Nurses and Midwives in Lodz, Poland. A total of 1117 nurses and midwives was randomly selected for the study, based on the registry database (i.e. ~30% of the registered persons in this age group), and out of these 924 women (83%) were contacted. The inclusion criteria (age 40-60 years and current employment as a nurse in public health care setting in Lodz) were confirmed for 866 women, and 725 (84% of the eligible subjects) women agreed to participate in the study. A structured questionnaire was administered during in-person interviews and information was obtained on the subjects' occupational history, demographics, medical and reproductive history, hormone use, smoking and alcohol use, diet, and sleep quality. Data on physical activity were collected according to the international questionnaire on physical activity – IPAQ in its full version(Craig et al., 2003), which covers 7 days before the interview. Morning or evening preference was determined with the use of a single question on "lark" or "owl" personality with the explanation of these terms provided therein. Body weight and height were measured and BMI calculated.

The study was approved by the ethical institutional review board at the Nofer Institute of Occupational Medicine. A signed informed consent was obtained from each study participant.

The study conformed to international ethical standards accordingly to guidelines provided in Portaluppi et al. (Portaluppi et al., 2010).

Physical activity (PA) variables

Based on the IPAQ guidelines for the computation of continuous variables, we calculated MET[1]-hours per week for each category of physical activity listed in the questionnaire. MET-metabolic equivalents were assigned according to the IPAQ guidelines, as follow: for walking – MET=3.3, moderate intensity activities - MET= 4, and for vigorous - MET=8. In the analysis, we used variables describing work domain, active transportation domain, domestic and garden domain and leisure time domain. Leisure time domain covered activities related to recreation and sports during leisure time (e.g. walking, sports, aerobics, running, bicycling, and swimming). Physical activity at work covered walking, moderate and vigorous activities. The total PA was calculated as the sum of all four domains. Based on the data on leisure time activity, an additional variable discriminating inactive women was created, and all women who reported no leisure time activity were identified as recreationally "inactive".

Night shift exposure assessment

Data on the current job collected via the questionnaire were used. The current job characteristics were analyzed with the following variables specified: current rotating night shift work *(yes/no)*, night shift work frequency *(2-7, 8-14 night shifts per month)*, and duration of effective working hours during a night shift – which was calculated by subtracting the time of napping from the total duration of the night shift *(<10 hours, 10-14 hours)*. In addition subjects' total night shift work history was analyzed and total duration of jobs with night shift

[1] *MET – metabolic equivalent* ratio of the metabolic rate to a standard resting metabolic rate of 1

MET = 1 resting metabolic rate during quiet sitting

1 MET ≈3.5 ml O_2 kg^{-1} min^{-1} in adults

work (years (calculated as the sum of the duration of each job with night shifts) *) (≤ 5yrs, >5-≤ 15, >15-≤ 25, >25)*.

Statistical analysis

Arithmetic means with standard deviations and the frequencies of the basic characteristics were calculated. The Student's t-test was used to compare the means of the continuous variables, and the chi-square test was used to compare the frequencies' distribution among the women working on rotating night shifts and the day workers.

Medians of MET hrs per week score for each PA domain were calculated in the quantile regression analyses. Apriori list of confounders included age (continuous), calendar season of the year (October - March vs. April-September), marital status (never married, married/cohabitating, divorced, or widowed), and BMI (continuous).

Giving birth or having children has been found to influence physical activity of women in some previous research (Brown & Trost, 2003; Sternfeld et al., 1999). In this study current night shift nurses tended to have more full term births than day workers and univariate analyses showed statistically significant association between full term births and each of the physical activity domain (apart from transportation), thus it has been included in the multivariate models.

The odds ratios of recreational "inactivity" was calculated with the use of the logistic regression model adjusted for the above-listed confounders.

Additional analyses were run with all PA domains introduced into the models for their mutual adjustment. None of the results changed substantially, though, and these data are not presented. We also run multivariate analyses including into the models variable for place of work (with four categories specified: only hospital, only out-patient clinic, both-hospital and

outpatient clinic, and other places. The results did not materially change and thus are not presented.

The sensitivity analyses focused on women according to their chronotype. The Wald test was used to determine the statistical significance of the effect modification.

Statistical analyses were performed with STATA 11 (StataCorp LP).

Results

The selected characteristics of the surveyed nurses and midwives according to their current type of work are presented in Table 1. The rotating night shift nurses and midwives were slightly younger than the day shift nurses (age difference 1.9 yr), with more pre-menopausal women among them (65% vs. 52%). The statistically significant differences between the groups were observed for age at menopause, number of full-term births and current smoking (more frequent in the rotating night shift nurses). The interviews were held during the spring and summer more often in the rotating night shift nurses.

Women working rotating night shifts had been working at nights for an average of 25.4 years, and 92% had worked night shifts for more than 15 years. The women who were currently working days only, but who had a history of night shift work, had, on average, worked 12 years on night shifts, and 65% of them had night shift work history shorter than 15 years (Table 1). Out of these women, the majority (83%) had changed to day work more than 5 years before their recruitment into the study. The arithmetic means of work related physical activity and total physical activity were statistically significantly larger in current night shift nurses than day shift nurses(195.2 MET hrs per week vs 141.0 and 262.3 vs 207.3 respectively).

The majority of the night shift nurses and midwives (87.6%) reported working, on average, from 2 to 7 nights per month at the current job, with 12 hours on duty, typically between 7 p.m. and 7 a.m.

Rotating night shift work and physical activity

The work-related PA domain was the major component of the total PA (75% in the rotating night shifts nurses and 68% in the day shift nurses). In the studied population of women, the leisure time PA contributed the least to the total physical activity in both compared groups of women. The adjusted median for the total PA and work-related PA was statistically significantly higher in women working rotating night shifts than in those working day shifts only (Table 2). No statistically significant differences were observed for other domains of PA, although, leisure time PA was slightly lower in the rotating night shift nurses, compared to those working on day shifts only.

(The study had power 80% to detect difference of the medians by current work system of 13% for work domain, 33% for household and gardening 28% for active transportation, and 68% for leisure time PA domain.)

The intensity of the night shift work measured by the frequency of night shifts per month and effective night shift work hours tended to be linked with an increase in the work domain, active transportation and the total PA, with statistically significantly higher MET hrs per week scores for active transportation and the total PA in women with ≥10 effective night shift hours. Longer night shift work duration was associated with statistically significant higher median of work domain PA and total PA, but lower leisure-time and active transportation PA.

In the analyses of PA domains stratified by chronotype we observed a statistically significantly lower median of the recreational activity score among the morning type rotating night shift nurses, but not the evening type, compared to women working during the days only

within the respective chronotype (MET hrs per week 6.6 vs 10.3, p for the difference 0.041 in larks) but formal statistical test have not confirmed statistically significant heterogeneity by chronotype (p= 0.18)(data not shown).

In the studied population, about 1/3 of the night shift nurses and 1/4 of the day shift nurses reported no leisure time activity. The odds ratio of recreational "inactivity" was significantly increased among the rotating night shift nurses and midwives (OR=1.57, 95% CI:1.11 – 2.20), and further among the women reporting 8 and more night duties per month (OR =2.22, 95%CI: 1.17-4.58) (Table 3). In the analysis restricted to the current rotating night shift nurses and midwives, the being "inactive" tended to be associated with more frequent night shift work (OR= 1.60, 95%CI: 0.80-3.17 – ≥8 night shifts per month vs. 2-7 night duties), rather than with more effective night shift hours (OR=0.90, 95%CI: 0.52-1.53 – ≥10 effective hours vs. < 10 hours during the night shift). No significant relationship was also found when effective hours were analysed as continuous variable. (data not shown).

Leisure time "inactivity" was statistically significantly associated with the rotating night shift work status in the morning type females but not evening type (OR=1.95, 95%CI: 1.21-3.15 and OR=1.20, 95%CI: 0.70-2.00, respectively). Nevertheless, formal statistical tests did not confirm any significant modifications.

Current guidelines for healthy adults recommend accumulation of at least 150 minutes per week of moderate to vigorous aerobic physical activity to achieve health benefits (Physical Activity Guidelines Advisory Committee, 2008; Tremblay et al., 2011). These guidelines were met by majority of women in our study (92%), mostly due to activity at work, but only 28 women (3.4% of night shift, and 4.3% of day workers) reported at least 150 minutes of recreational moderate or vigorous physical activity, which indicates the need for intervention in this field.

Discussion

In this cross-sectional study of nurses and midwives, we examined the associations between rotating night shift work and various domains of physical activity as measured with a standardized questionnaire-based tool (IPAQ). Our study showed that while work related PA and total PA were higher the leisure time activity tended to be scantier in women working night shifts when compared to women working day shifts only. Not engaging in leisure time activity was associated with night shift work particularly in women with more frequent night duties and longer duration of the night shift work.

Higher work related PA among rotating night shift nurses is well justified by their employment place. We confirmed such an association in the additional analysis for place of current work, whereas physical activity at work was significantly higher at hospitals when compared to outpatient clinics. Majority of women working rotating night shifts, at the moment of survey, were employed at hospitals(86%), where routine work tasks involve patients handling (eg. care of patients with disabilities, repositioning patients in bed, helping patient to bath, moving beds, making beds , etc.). All of these tasks are physically demanding, and there have been abundant research devoted to study hospital nurses work load, ergonomics and musculoskeletal disorders (Fochsen et al., 2006; Long et al., 2012; Yassi & Lockhart, 2013). In contrary most of day shift nurses worked at outpatient clinics, where patients do not require that much assistance as at hospitals, thus their physical activity at work were significantly lower.

So far, only a limited number of studies have addressed the issue of leisure time physical activity among nurses working night shifts. Moreover, different authors used various tools and measures of physical activity precluding the direct comparison with the results of our analysis. Nevertheless, some support for lower leisure time activity among nurses

working on night shifts can be found in the literature. In a large study of Finnish nurses working at 10 hospitals, the frequency of sedentary lifestyle was by 31% (not significantly) increased in shift workers compared to day workers (Kivimaki et al., 2001). In a case-control study among Danish female nurses, the authors reported a significantly lower average number of hours spent on sports activities (2.8 *vs.* 4.2) among nurses ever working after midnight (≥1 year), compared to those women who were classified as never working after midnight(Hansen & Stevens, 2012). Further support comes from a few studies in other occupational groups of employees working night shifts (Bushnell et al., 2010; Nabe-Nielsen et al., 2011). There are also studies that have not reported differences in physical activity between day and night shift workers (Pietroiusti et al., 2010; Zhao et al., 2012) or even higher physical activity as observed in the Million Women Study (Wang et al., 2012). The inconsistency of the results may be attributed to differences in workplaces, jobs, and shift systems, as well as differences in lifestyles across countries.

In our study leisure time inactivity was associated with current night shift work, its duration and intensity as measured by night duties frequency and night shift work effective hours. In comparison to day workers statistically significant increase of leisure time inactivity was observed for each of the categories of the intensity measures. When analysis was restricted to current night shift workers frequency of night duties per month rather than effective night shift work hours mattered.

The sensitivity analyses that we performed suggested that recreational "inactivity" characterized largely the women of the morning preference type personality with significantly lower median of MET hrs per week of leisure-time PA observed among rotating night shift "larks" only, and significant OR of recreational "inactivity" in this group. One of the interpretations of this finding may be that morning type women cope poorer with rotating night shift work, which may results in scantier lifestyle including lack of exercising. Thus, our

results support Atkinson et al.'s suggestion that "workers who cope well with shifts might be more inclined to exercise than those who do not cope with shifts so well"(Atkinson et al., 2008). A recent review has reported that the individual differences in the tolerance to shift work are dependant, among others, on age and the circadian type, with the majority of studies showing that younger age and low scores on morningness are related to shift work tolerance(Saksvik et al., 2011).

Physical activity has been defined as "any bodily movement produced by skeletal mussles that results in energy expenditure" (Caspersen et al., 1985). Although every type of physical activity adds to energy expenditure (energy balance), exercising seems to play a major role in maintaining health. For example, in respect to breast cancer – the most studied cancer outcome potentially associated with night shift work – one of the recent reviews showed that each type of activity contribute to breast cancer risk reduction, but the stronger effect has been observed for recreational and household activity(21%) than that of occupational activity(13%) (Friedenreich & Cust, 2008). It has been already demonstrated that exercising intervention brings health benefits to the workers e.g. a decrease in the body mass index, decreased blood pressure and total cholesterol, reduced smoking, increase of the physical fitness, sleep length, reduction of the work-dependent fatigue and also musculoskeletal symptoms (Harma et al., 1988; Shephard, 1996), which could be particularly relevant for night shift workers.

The strength of our study is that it was conducted in a well-characterized population of women. As observed by other authors, nurses represent a reliable population, with usually higher participation rates and better recall than that of the general population. For the determination of physical activity, we used a standardized tool. The IPAQ questionnaire covers all important domains of PA, and has been validated to be a reasonably good tool for measuring PA in adults (Craig et al., 2003; Hagstromer et al., 2006). Although, IPAQ

measures physical activity during one week before the interview a high correlation (Spearman correlation coeficient ρ ~0.68) between 7 days and usual physical activity as measured by IPAQ has been reported (Craig et al., 2003), thus it could represent typical PA of women.

One potential limitation of our study relates to differences in the year season when interviews were held between groups of women working rotating night shift and day nurses. Typically season of the year might influence outside activities and in our study season was significantly associated with leisure-time activity and domestic and gardening. Relatively more women working night shifts had interviews during spring and summer comparing to these working night shifts, which could potentially result with higher reported PA related to some outside activities (recreational or gardening). But we observed lower leisure time activity in the rotating night shift nurses, and no difference was observed between groups for domestic PA. In all the analyses season of the year was introduced in the models in order to control for this confounder.

Another potential limitation is the classification of women to the certain category by chronotype using a simple question on the morning or evening preference. We acknowledge that such crude assessment could result with some misclassification. It has been argued, however, that single question on diurnal preference correlated well with more comprehensive questionnaires (Hansen & Lassen, 2012). Nevertheless, future studies using better tools for the assessment of chronotype are needed to confirm our findings.

In addition some limitations may apply to the study in respect to its generalization to populations of night shift workers other than nurses and other countries. Of importance here is that nurses in Poland work rotating system, mostly with 12 hours long two shifts, while at industry the most prevalent is system that includes three shifts, with five consecutive shifts (Peplonska et al., 2013), and thus consequences to lifestyle may differ. Given cross-national social and lifestyle differences the limitation may also apply to generalization of the results to

nurses in other countries, in particular, if their system of work is different. Further studies of physical activity of night shift workers in other countries are warranted to clarify these issues.

In conclusion, our study demonstrated higher overall and occupational physical activity among nurses and midwives working rotating night shifts, but lower leisure-time physical activity at this group. Initiatives supported exercising among night shift workers are recommended.

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Declaration of interest statement

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Table 1 Selected characteristics of Polish nurses and midwives. A cross-sectional study

Characteristics	**Rotating night shifts n=354**		**Day shifts n=371**		**p-diff**
	%	**mean (SD)**	**%**	**mean (SD)**	
Mean age (years)		48.3 (5.2)		50.2 (5.3)	<0.001
Menopausal status					
Pre-	65		52		<0.001
Post-	35		48		
Age at menopause (in postmenopausal women) (years)		48.5(4)		49.6(4)	0.02
Age at menarche (years)*		13.3(1.4)		13.1(1.6)	0.06
Age at first full-term birth (≥37wks) (years)					
≤24	56		56		0.43
>24- <30	32		35		
≥30	12		9		
Number of full-term births					
0	12		13		
1	31		35		0.04
2	49		49		
3-4	8		3		
BMI (kg/m^2)					
<25	35		38		0.54
25-30	40		40		
> 30	25		22		
Smoking					
Current	35		26		0.02
Past	23		31		
Non-smoker	42		43		
Chronotype*					
Morning type	51		53		0.32
Evening type	49		46		
Marital status					
Never married	5		4		
Married/cohabitating	77		75		0.59
Divorced	13		15		
Widow	5		6		
Season of the year when interview held					
April-September	45		35		0.01
October-March	55		65		
Alcohol consumption (drinks per week)		0.6 (0.7)		0.6 (0.7)	0.70
Night shift work years (years)		25.4 (7)		12.1 (8)	<0.001
Total night shift work years					
- ≤5	1		23		
>5 - ≤15	7		42		<0.001
>15- ≤ 25	43		28		
>25	49		7		
Physical Activity (MET* hrs/week)					
Leisure-time		11.7 (19.0)		13.2 (21.7)	0.31
Household and gardening		28.4 (31.0)		26.3 (26.7)	0.32

Active transportation	27.2 (38.7)	26.8 (36.5)	0.87
Work	195.2 (81.3)	141.0 (70.9)	<0.001
Total	262.3 (110.8)	207.3 (99.7)	<0.001

* missing information for: menarche in 2 night shift and 2 day shift nurses; chronotype in 2 day shift nurses

Table 2 Adjusted medians with 95% CI of energy expenditure (MET hrs per week) according to the night shift work characteristics

Characteristics (n)	PA domain MET hrs per week Median[a] (95%CI)				
	Leisure-time	Household and gardening	Active transportation	Work	Total
Day shifts (371)	8.6 (7.2-10.0)	18.5 (17.9-19.0)	15.6 (14.3-17.0)	130.8 (121.9-139.8)	187.4 (174.3-200.5)
Rotating night shifts (354)	7.1 (5.6-8.4)	18.9 (18.4-19.4)	13.9 (12.6-15.3)	183.2 (174.0-192.3)	236.3 (223.0-249.6)
p	*0.12*	*0.81*	*0.11*	*<0.001*	*<0.001*
Night shift work frequency (per m.)					
2-7 (312)	7.0 (5.4-8.5)	18.7 (18.1-19.2)	13.9 (12.4-15.3)	181.5 (172.0-191.1)	234.7 (221.1-248.4)
8-14 (42)	7.0 (2.7-11.2)	20.3 (18.8-21.8)	15.8 (11.5-20.1)	187.0 (164.7-212.5)	250.8 (213.5-288.1)
p [b]	*0.67*	*0.34*	*0.09*	*0.17*	*0.17*
Effective night shift work hours					
<10 (93)	4.9 (2.8-6.9)	16.6 (13.6-19.6)	10.9 (8.0-13.8)	167.8 (148.2-187.4)	219.1 (195.6-242.4)
≥10-14 (255)	7.5 (6.2-8.7)	20.5 (18.6-22.3)	15.3 (13.5-17.0)	185.3 (173.9-197.3)	246.4 (232.8-260.7)
p [b]	*0.26*	*0.02*	*0.01*	*0.16*	*0.04*
Nigh shift work duration(yrs)					
≤5 (87)	10.3 (8.0-12.7)	18.2 (17.1-19.3)	19.4 (16.4-22.5)	131.5 (115.6-147.5)	189.0 (164.7-213.2)
>5-≤15 (182)	9.5 (7.9-11.2)	18.5 (17.7-19.3)	15.0 (12.9-17.1)	139.5 (128.5-150.6)	198.6 (181.8-215.3)
>15-≤25 (258)	6.8 (5.5-8.2)	18.7 (18.1-19.3)	15.1 (13.4-16.9)	160.3 (151.0-169.7)	218.3 (204.1-232.4)
>25 (198)	6.3 (4.7-7.9)	18.3 (18.1-19.5)	13.5 (11.5-15.5)	173.8 (163.1-184.4)	223.1 (206.9-239.2)
p	*0.001*	*0.99*	*0.01*	*<0.001*	*0.001*

[a] adjusted for age (continuous), number of full-term births (0, 1,2,3+), marital status (never married, married/cohabitating, divorced, widowed), calendar season of the year (October-March vs. April-September) and BMI (continuous)

[b]- p for the difference in the estimated median in the current rotating night shift nurses and midwives

Table 3 Odds ratios of recreational "inactivity" according to rotating night shift work characteristics in the total population and by chronotype *(reference: women working day shifts)*

Rotating night shift work characteristics	Adjusted* Odds ratio, 95%CI		
	Total population N = 725	Morning type** N = 380	Evening type** N = 343
Current night shift work			
No (371)	1.00	1.00	1.00
Yes (354)	1.57 (1.11-2.20)	1.95 (1.21-3.15)	1.20 (0.70-2.00)
p	*0.01*	*0.006*	*0.478*
p-heterogeneity		0.33	
Night shifts frequency (per month)			
Day shifts (reference)(369)	1.00	1.00	1.00
2-7 (314)	1.49 (1.04-2.1)	1.87 (1.14-3.08)	1.06 (0.64-1.78)
8+ (42)	2.22 (1.17-4.58)	2.53 (0.99-6.46)	2.16 (0.79-5.86)
p	*0.004*	*0.006*	*0.257*
p-heterogeneity		0.58	
Night shift work effective hours			
Day shifts (reference)(369)	1.00	1.00	1.00
< 10 (93)	1.75 (1.05-2.91)	2.53 (1.27-5.07)	1,06 (0.48-2.32)
≥10 – 14 (255)	1.47 (1.02-2.12)	1.76 (1.03-2.98)	1.21 (0.70-2.10)
p	*0.035*	*0.027*	*0.490*
p-heterogeneity		0.40	
Nigh shift work duration (yrs)			
≤5 (87)	1.0	1.0	1.0
>5-≤15 (182)	1.42 (0.74-2.72)	1.09 (0.46-2.60)	1.75 (0.64-4.79)
>15-≤25 (258)	1.66 (0.89-3.09)	1.45 (0.64-3.27)	1.79 (0.65-4.90)
>25 (198)	2.57 (1.37-4.79)	2.31 (1.01-5.27)	2.74 (1.01-7.3)
p	*0.001*	*0.016*	*0.043*
p-heterogeneity		0.85	

* adjusted for age (continuous), number of full-term births (0, 1,2,3+), marital status (never married, married/cohabitating, divorced, widowed), calendar season of the year (October-March vs. April-September), BMI (continuous)

** the numbers do not sum up to total due to missing information about chronotype in 2 day shift nurses