

Finnish Institute of
Occupational Health

Night shift work and breast cancer risk

A cohort study based on payroll and survey
data from Finland

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Background

- Over 10 epidemiologic studies on night work and breast cancer have been published after the latest IARC evaluation concluding that night shift work probably causes breast cancer
- Most of the also the new publications have lacked sufficiently precise exposure information on night shift work
- This study aimed
 - to examine the association between different shift work characteristics and the risk of breast cancer
 - To identify effect modifiers

Why do we need precise exposure information on shift work?

- To define complicate, diversified and irregular working hour patterns precisely
- To decrease the risk for information bias
- To be able to give more detailed recommendations for the practise

Population

- We linked payroll-based daily working hour records from the Working Hours in The Finnish Public Sector (WHFPS) cohort with survey data and national breast cancer registry data (ICD10=C50)
- The cohort consisted of 42 379 women in the social and health care sector who had:
 - entered the FPS/WHFPS cohort in 2008- 2018
 - responded to ≥ 1 FPS questionnaire at baseline (year of entry)
 - ≥ 1 year of payroll data available prior to the start of the cancer follow-up

Women diagnosed with breast cancer prior to base line and during the exposure period were excluded (N=592)

- The average response rate across FPS surveys was 70%

Variables

- Exposure (from the payroll data)

Annual number of: any shifts; non-day shifts; morning shifts; evening shifts, night shifts lasting ≥ 8 , 10, or 12 hours; quick returns following the last shift (11 hours) and the last night shift (< 24 or 49 hours); the annual frequency of sequences with any, ≥ 3 , or ≥ 5 consecutive night shifts; the yearly ration of night shifts to total shifts

- Exposure (survey)

Regular day work, shift work with night shifts, shift work without night shifts, permanent night work

- Effect modification variables

Sleep problems (Jenkins), fatigue at work and fatigue during free-time, chronotype (Diurnal type scale), psychological distress (GHQ),

- Covariates

Age, marital status, socioeconomic status, BMI, smoking, alcohol consumption, physical activity, job demands, job control, worktime control

Design and statistical analysis

- Prospective study of incident breast cancer of maximum 14-year follow-up (2009- 2022)
- To identify effect modifiers, subgroup analyses were performed based on participants' age at study entry (<50 vs. ≥ 50 as a proxy for menopausal status), insomnia, fatigue, chronotype and psychological distress
 - Multiplicative effect modification was assessed by including interactions terms between the type of shift work and the effect modifiers
- Cox proportional hazards model was used to analyze the data, utilizing cause-specific hazard model. Hazard ratios (HR) were adjusted for the relevant covariates
 - Person- time was calculated for each participant from the end of exposure period up to the date of death, cancer diagnosis or the end of follow-up (31.12.2022).
 - We accounted for the clustering effect of work units as the intraclass correlations coefficient for units exceeding the threshold limit of 0.05. Proportional hazard assumption was tested (Schoenfeld residuals) against time and the log-log plots

Results

Descriptive statistics

- We found 945 breast cancer cases among the 42 379 women in social and health care
- The mean follow-up time was 9.8 years (SD 3.1 years).
- Maximal follow-up time was 14 years.

Table 1. Baseline characteristics of the study population (N=42 379).

Characteristic	%
Age (years)	
17–29	16
30–39	22
40–49	27
50–59	28
60–72	7
Socioeconomic status	
Upper white collar	60
Lower white collar	21
Skilled blue collar	15
Other blue collar	5
Ever smoking	37
Body mass index	
Overweight (body mass index 25.0–29.9 kg/m ²)	30
Obesity (body mass index >30.0 kg/m ²)	21
Chronotype	
Morning	52
Evening	48
Type of shift work	
Regular day work	44
Shift work without night shifts	27
Shift work with night shifts	25
Permanent night work	2
Other irregular work	3
Sleep problems (Jenkins)	51
Psychological distress	57
Fatigue at work at least once per week	60
Fatigue during free time at least once per week	45

Results

Table 2. The associations of shift and night work characteristics at baseline with breast cancer risk in the total sample. [HR=hazard ratio; CI=confidence interval.]

Characteristic at baseline	Sample	Cancer cases	Age-adjusted		Multivariable *	
			HR	95% CI	HR	95% CI
Type of shift work, self-reported						
Regular day work	18 116	449	1		1	
Shift work without night shifts	11 194	242	0.93	0.80–1.09	0.99	0.83–1.17
Shift work with night shifts	10 161	197	0.92	0.78–1.09	0.92	0.76–1.12
Permanent night work	782	22	1.23	0.82–1.86	1.07	0.67–1.73
Other irregular work	1096	21	0.69	0.45–1.06	0.66	0.40–1.08
Number of non-day shifts						
None	14 015	343	1		1	
Below median	14 035	301	0.92	0.79–1.08	0.94	0.79–1.11
Above median	14 048	296	1.00	0.86–1.17	0.98	0.83–1.17
Number of morning shifts						
Low	14 044	279	1		1	
Medium	14 014	296	0.97	0.82–1.14	0.99	0.83–1.18
High	14 040	365	1.10	0.94–1.28	1.10	0.93–1.31
Number of evening shifts						
None	19 480	479	1		1	
Below median	11 315	227	0.92	0.78–1.08	0.96	0.80–1.14
Above median	11 303	234	1.02	0.88–1.20	1.01	0.85–1.21
Number of night shifts >8 hours						
None	28 626	678	1		1	
Below median	6732	137	1.01	0.83–1.21	0.95	0.77–1.17
Above median	6740	125	0.99	0.82–1.20	0.97	0.78–1.21

The associations of shift work characteristics with breast cancer risk among age

Characteristic	Women younger than 50					Women aged 50 or older			
	Sample	Cancer cases	HR *	95% CI		Sample	Cancer cases	HR *	95% CI
Number of non-day shifts									
None	8,489	141	1			5,526	202	1	
Below median	9,039	123	0.84	0.65-1.10		4,996	178	1.01	0.81-1.26
Above median	9,613	91	0.70	0.52-0.94		4,435	205	1.25	1.01-1.55
Number of morning shifts									
Low	9,552	95	1			4,492	184	1	
Medium	9,112	119	1.15	0.85-1.54		4,902	177	0.88	0.71-1.10
High	8,477	141	1.36	1.01-1.82		5,563	224	0.94	0.76-1.16
Number of evening shifts									
None	11,635	188	1			7,845	291	1	
Below median	7,860	100	0.87	0.67-1.13		3,455	127	1.03	0.81-1.32
Above median	7,646	67	0.71	0.52-0.96		3,657	167	1.28	1.03-1.59
>2 consecutive night shift									
None	21,163	308	1			13,134	501	1	
Below median	2,981	23	0.69	0.45-1.06		787	32	0.85	0.54-1.32
Above median	2,997	24	0.73	0.44-1.22		1,036	52	1.64	1.22-2.21
>4 consecutive night shift									
No	25,735	342	1			14,417	560	1	
Yes	1,406	13	0.77	0.36-1.64		540	25	1.46	0.95-2.26
>4 consecutive night shift									
None	25,735	342	1			14,417	560	1	
Below median	772	9	1.17	0.48-2.83		202	14	2.58	1.47-4.53
Above median	634	4	0.32	0.08-1.26		338	11	0.88	0.45-1.76

* Adjusted for age, marital status, childbirth , socioeconomic status, smoking, alcohol consumption, body mass index, leisure-time physical activity, job demands, job control and worktime control

Effect modification by insomnia and fatigue

- Permanent night work with **sleep problems** (HR 1.75, 95% CI 1.01-3.09)
- Permanent night work with **fatigue at work** (HR 1.90, 95% CI 1.08-3.35)
 - similar patterns of elevated risk were observed among women < 50 and ≥ 50 years

Testing for multiplicative interaction:

- HR 3.64, 95% CI 1.13–11.74 for the interaction between permanent night work and **sleep problems**
- HR 3.60, 95% CI 0.99–13.05 for the interaction between permanent night work and **fatigue at work**
- Psychological distress and chronotype did **not** consistently modify the association

The association of type of shift work at baseline with breast cancer risk in women with sleep problems

HR=hazard ratio; CI=confidence interval

Characteristic	Women without sleep problems				Women with sleep problems *			
	Sample	Cancer cases	HR	95% CI	Sample	Cancer cases	HR *	95% CI
Total sample								
Type of shift work, self-reported								
Regular day work	8981	222	1		9118	227	1	
Shift work without night shifts	5112	102	0.93	0.72–1.21	6051	139	1.04	0.82–1.31
Shift work with night shifts	5029	100	0.96	0.73–1.26	5124	97	0.89	0.69–1.16
Permanent night work	443	7	0.51	0.19–1.38	337	15	1.76	1.01–3.09
Other irregular work	507	8	0.57	0.26–1.26	584	13	0.73	0.38–1.40
Women <50 years								
Type of shift work, self-reported								
Regular day work	5636	91	1		5386	91	1	
Shift work without night shifts	3295	35	0.78	0.51–1.20	3727	48	1.06	0.73–1.55
Shift work with night shifts	3752	44	0.81	0.54–1.21	3621	33	0.67	0.43–1.04
Permanent night work	293	2	0.28	0.04–1.20	224	6	1.81	0.78–4.23
Other irregular work	311	1	0.22	0.03–1.56	329	2	0.39	0.10–1.50
Women ≥50 years								
Type of shift work, self-reported								
Regular day work	3345	131	1		3732	136	1	
Shift work without night shifts	1817	67	1.07	0.78–1.47	2324	91	1.05	0.78–1.41
Shift work with night shifts	1277	56	1.12	0.76–1.63	1503	64	1.10	0.79–1.53
Permanent night work	150	5	0.76	0.24–2.41	113	9	1.87	0.88–3.95
Other irregular work	196	7	0.83	0.34–2.02	255	11	0.97	0.48–1.95

* Adjusted for age, marital status, living with a child, socioeconomic status, smoking, alcohol consumption, body mass index, leisure-time physical activity, job demands, job control, and worktime control.

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Conclusions

- In the whole group, we observed little associations between the different characteristics of shift work and the risk of breast cancer when compared to regular day work
- However, the risk was elevated among women aged ≥ 50 years according to the number of **non-day shifts**, **evening shifts**, and **>2 consecutive night shifts** sequences
- **Permanent night shift work** was associated with an increased risk of breast cancer **among all women who report sleep problems or fatigue at work**

Strengths	Limitations
- large sample size - payroll cohort linked to questionnaires - exposure assessment based on both objective and subjective data - high baseline response rate (70%) - several confounders like also job demands, obesity, smoking, physical activity and alcohol consumption were controlled	- follow-up period shorter for those entering the dynamic cohort later - limited power for exposure ≥ 5 consecutive nights and for the associations of sleep problems and fatigue - median splits may distort the underlying dose-response analysis - lack of some confounders age at first childbirth - possibility of chance findings cannot be ruled out due to the multiple testing

Conclusions

- The results provide evidence that both *shift scheduling* and *individual symptoms* related to sleep and fatigue may be relevant when evaluating potential health risks associated with night shift work => *screening of sleep problems among permanent night workers*
- Why different results among < 50 and ≥ 50 year old women?

=> Differential selection out of night shift work is possible

- Based on the European Working Time Directive (and the Finnish Working Time Act), symptoms and disorders of night shift workers have been screened in Finland in the obligatory OSH health checks since 1997. Employees with specific health problems have been instructed to be switched to day work, the practices in hospitals becoming more common during with later years.
- The younger population of this study has been in the working life mostly during the new law, while the older population (≥ 50 years at baseline) was not.

Thank you!

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