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A case-crossover study of age group differences in objective working-hour characteristics and short sickness absence

Annina Ropponen PhD, Adjunct professor | Aki Koskinen MSc | Sampsa Puttonen PhD, Adjunct professor | Mikko Härmä PhD, MD, Professor

Finnish Institute of Occupational Health, Helsinki, Finland

Correspondence
Annina Ropponen, Finnish Institute of Occupational Health, P.O.Box 18, 00032 Työterveyslaitos, Helsinki, Finland.
Email. annina.ropponen@ttl.fi

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Abstract

Aim: To investigate age group differences in objective working-hour characteristics and their associations with short (1–3 days) sickness absence.

Background: Irregular working hours, that is shift work with non-standard schedule, may influence sickness absence rates in hospital workers.

Methods: We collected daily working hours and the first incidence of short sickness absence from the employers' electronic records from 2008 to 2017. A case-crossover study compared the characteristics of the working hours 28 days preceding the sickness absence (exposure window) and 28 days earlier (control window) across 10-year age groups (conditional logistic regression for odds ratios (OR) with 95% confidence intervals (95% CI)).

Results: Younger employees had longer working hours and more night and consecutive shifts. Extended weekly working hours were associated with short sickness absence in all age groups. Age-related differences were few: extended working hours among oldest age group (OR: 1.01, 95% CI: 1.00–1.01) and daily working hours in the youngest and middle-age groups (Ors: 1.14–1.17) were associated with increased sickness absence.

Conclusions: Length of working hours, and night and consecutive shifts differed between age, but the associations with short sickness absence were similar across all age groups.

Implications for Nursing Management: Among older employees, the length of working hours should be paid special attention.

KEYWORDS
ageing, nurses, shiftwork, nurses, sick leave, working time

1 | INTRODUCTION

Health care sector is facing major challenges due to population ageing (Eaton, 2019), increased need of care and economical challenges combined with lack of personnel (Tursunbayeva, 2019, Smiley et al. 2018). Health care is dominated by women (Betron et al., 2019), and in addition to otherwise demanding working conditions, irregular working hours are prevalent (Garde et al., 2019; Härmä, Karhula, Puttonen, et al., 2018; Ropponen, Koskinen, Puttonen, & Härmä, 2019). Due to population ageing (Eurofound, 2012), more and more elderly employees need to work irregular working hours.

High sickness absence rates cause considerable economical losses in health and social care (Leinonen, Viikari-Juntura, Husgafvel-Pursiainen, Virta, et al., 2018). Sickness absence is more common among women than among men (Leinonen, Viikari-Juntura, Husgafvel-Pursiainen, Virta, et al., 2018; Melsom & Mastekaasa, 2018). However, the sickness absence rates are not explained by the number of women in workforce nor by changes in the distribution of women and men across occupations or industries (Leinonen, Viikari-Juntura, Husgafvel-Pursiainen, Virta, et al., 2018; Mastekaasa, 2014). Instead, assumptions exist of a complex interplay between industrial sectors and occupational classes for differences in sickness absence rates (Leinonen, Viikari-Juntura, Husgafvel-Pursiainen, & Solovieva, 2018a). One of the factors contributing to this complexity is working conditions including working hours (Pekkala, Blomgren, Pietilainen, Lahelma, & Rahkonen, 2017).

Irregular shift work, that is shift work with a non-standard schedule that includes varying start and finish times, shift lengths and rest periods between shifts (Sallinen & Kecklund, 2010), is one possible reason for the high sickness absence rates in health and social care (Dall'Ora et al., 2018; Ropponen et al., 2017) besides ageing and demanding working conditions (Alexanderson & Norlund 2004, Vahtera, Kivimaki, Pentti, & Theorell, 2000). Shift work has several negative health effects, such as occupational accidents, type II diabetes, cardiovascular disease and certain cancers, and the health effects evidently exist among both sexes (Gan et al., 2015; Pahwa, Labreche, & Demers, 2018; Vedaa, Harris, et al., 2019; Wang, Armstrong, Cairns, Key, & Travis, 2011) and among the elderly population (Härmä, 2006). The most probable pathways between shift work and health are related to insufficient sleep and recovery and disrupted circadian rhythms while working in the nights (Åkerstedt, Hallvig, & Kecklund, 2017; Sallinen & Kecklund, 2010). Although sickness absence is a proxy for health, it also reflects psychosocial working conditions (Kivimaki et al., 2003; Marmot, Feeney, Shipley, North, & Syme, 1995).

Studies on shift work and sickness absence have yielded mixed findings. Some studies indicate increased risk of sickness absence due to long working hours (Dall'Ora et al., 2018), while some show negative associations (Bernstrom, 2018; Vedaa, Pallesen, et al., 2019). Our earlier studies, based on the Finnish Public Sector study, indicated that long working hours, several consecutive night shifts and short (<11 hr) recovery periods between the shifts are associated especially with short (1–3 days) sickness absence (Ropponen et al., 2019) but also with fatigue and sleep disturbances (Härmä, Karhula, Puttonen, et al., 2018; Härmä, Karhula, Ropponen, et al., 2018). Yet, these studies did not investigate age group differences, and it could be assumed that younger and older workers in female-dominated social and health sector might react differently for working-hour characteristics, and consequently, rates of sickness absence could differ (Cai et al., 2019; Stock et al., 2019; Ticharwa, Cope, & Murray, 2019).

Working-hour characteristics may also change according to seniority and possibilities to select more favourable working hours (Hess, Bauknecht, & Pink, 2018; Vanajan, Bultmann, & Henkens, 2019). This could explain some earlier negative results on age-related trends in the association of shift work and health (Booker, Magee, Rajaratnam, Sletten, & Howard, 2018; Ritonja, Aronson, Matthews, Boivin, & Kantermann, 2019). The earlier negative results on the association of shift work and sickness absence may also be due to lack of detailed information on working-hour characteristics (Ropponen et al., 2019). In general, register-based data on working hours have only recently become available to study the association of shift work with sickness absence (Dall'Ora et al., 2018; Ropponen et al., 2019; Vedaa, Pallesen, et al., 2019; Vedaa et al., 2017).

First, we hypothesized that realized working-hour characteristics are less strenuous among older shift workers. Second, since both ageing and shift work are associated with insomnia and increased need for recovery (Härmä, Karhula, Puttonen, et al., 2018), we hypothesized that ageing shift workers would also be more sensitive to short sickness absence in shift work. In order to investigate these hypotheses, we studied, first, age group differences in objective working-hour characteristics among women in hospital work and, second, the associations of working-hour characteristics with short (1–3 days) sickness absence in different age groups.

2 | DESIGN AND METHODS

2.1 | Sample

The data came from the Finnish Public Sector study (Härmä, Ropponen, Hakola, Koskinen, Vanttola, et al., 2015; Kivimaki et al., 2009). In total, we had working time data from 41 313 hospital employees from 1 January 2008 to 31 December 2017. The selection criteria for the final sample were having at least one short (1–3 days) sickness absence since 1 January 2008 and having data on work shifts during 56 days before the first short sickness absence (n = 21,440, 2,833 men and 18,607 women). We restricted the analyses to women and the first incidence of short sickness absence.

The final sample included only those with shift work schedule based on monthly average frequency of morning, evening and night shifts for a three-month period at the time for 1st incident sickness absence, that is shift work with or without night shifts (≥1 morning shift and ≥1 night shift or ≥1 evening shift, n = 12,761 for the final sample) (Härmä et al., 2017). To investigate age group differences, we further split the data into 10-year age groups: ≤25 years,> 25 and ≤35 years,> 35 and ≤45 years,> 45 and ≤55 years, and > 55 years.

2.2 | Working-hour data

The registry-based daily working-hour data were retrieved from the shift scheduling program Titania® with actual payroll-based working time data (i.e. start/end of work and absences including days off, sickness and other leaves), work unit and shift rota unit (Härmä, Ropponen, Hakola, Koskinen, Vanttola, et al., 2015). We classified

TABLE 1 Means (with standard deviations, *SD*) and proportions of working-hour characteristics in case exposure and control windows among women

	Shift work (*n* = 12,761)																			
	≤25 years (*n* = 2,618)				>25 and ≤35 years (*n* = 3,183)				>35 and ≤45 years (*n* = 2,470)				>45 and ≤55 years (*n* = 2624)				>55 years (*n* = 1,341)			
	Exposure window		Control window		Exposure window		Control window		Exposure window		Control window		Exposure window		Control window		Exposure window		Control window	
Working-hour characteristics	Mean	*SD*	Mean	*SD*	Mean	*SD* I	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Length of working hours																				
Daily working hours (hr)	8.2	0.9	8.2	0.9	8.4	1.1	8.4	1.1	8.3	1.0	8.3	1.0	8.2	0.9	8.2	0.9	8.1	0.9	8.1	0.9
Weekly working hours (hr)	30.9	6.1	30.2	6.9	29.1	7.5	28.1	8.5	28.0	7.7	26.9	8.7	28.4	7.9	27.3	8.8	27.0	8.6	25.7	9.3
>40 hr weeks of all working weeks	21	20	20	20	19	20	18	20	16	19	15	19	18	20	17	19	17	19	14	18
>48 hr weeks of all working weeks	5	11	5	11	4	11	5	11	4	10	4	10	4	10	4	10	3	9	3	8
>12 hr shifts	4	11	4	11	5	15	5	15	4	13	4	13	3	11	3	11	2	8	2	8
Time of day																				
Morning shifts	53	21	54	22	56	26	56	27	57	27	57	28	57	26	57	26	56	24	55	25
Day shifts	11	18	11	18	10	17	9	17	13	21	13	21	15	21	15	22	18	23	19	24
Evening shifts	24	19	23	19	20	19	20	19	17	19	17	19	18	19	18	19	17	19	17	20
Night shifts	12	15	12	15	14	19	14	20	13	22	13	22	11	20	11	21	9	19	9	20
Shift intensity																				
Quick returns	22	15	22	16	19	17	19	17	17	17	18	18	19	18	19	18	21	19	21	20
Number of consecutive shifts	2.4	0.8	2.4	0.9	2.2	0.9	2.2	0.9	2.2	0.9	2.1	0.9	2.2	0.9	2.1	0.9	2.1	0.9	2.0	0.9
Thresholds	% of group[a]		% of group[a]		% of group[a]		% of group		% of group[a]		% of group[a]		% of group[a]		% of group[a]		% of group[a]		% of group[a]	
0–1 quick returns/28 days	31		33		46		46		51		53		46		48		45		50	
2–4 quick returns/28 days	51		49		41		42		38		37		39		39		39		36	
5-11 quick returns/28 days	18		18		13		12		11		10		14		13		16		14	
>25% quick returns of all shift intervals	41		41		35		36		32		32		36		38		41		39	
Length of working hours																				
>25% > 40 hr weeks of all work weeks	21		19		18		16		14		13		16		15		14		11	
>25% > 48 hr weeks of all work weeks	2		2		2		2		1		1		1		1		1		1	
Time of day																				
>25% evening shifts of all shifts	49		48		40		40		33		33		35		36		33		33	
>25% night shifts of all shifts	17		16		19		19		18		18		14		14		11		13	

(Continues)

TABLE 1 (Continued)

Working-hour characteristics	Shift work (*n* = 12,761) ≤25 years (*n* = 2,618) Exposure window		Control window		>25 and ≤35 years (*n* = 3,183) Exposure window		Control window		>35 and ≤45 years (*n* = 2,470) Exposure window		Control window		>45 and ≤55 years (*n* = 2624) Exposure window		Control window		>55 years (*n* = 1,341) Exposure window		Control window	
	Mean	*SD*	Mean	*SD*	Mean	*SD* I	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Shift intensity																				
Number of consecutive evening shifts ≥4 shifts	0		0		0		0		0		0		0		0		0		0	
Number of consecutive evening shifts ≥2 shifts	12		11		8		7		6		5		6		6		5		6	
Number of consecutive night shifts ≥4 shifts	3		3		5		4		5		4		4		3		3		3	
Number of consecutive night shifts ≥2 shifts	17		16		17		16		14		11		11		10		8		8	

[a]Proportion of workers within the age group with prevalent working hour characteristics in exposure or control window.

work shifts as has been done before into morning shift (starting after 03:00 hr and ending before 18:00 hr), day shift (starting after 08:00 hr and ending before 18:00 hr), evening shift (starting at any time between 18:00 and 23:00 hr and not categorized as a night shift) and night shift (≥3 hr of work between 23:00 and 06:00 hr) (Härmä, Karhula, Puttonen, et al., 2018; Härmä, Ropponen, Hakola, Koskinen, Vanttola, et al., 2015). The definitions of shifts were not mutually exclusive; that is, a shift may fit in to more than one of the shift categories. Hence, we prioritized the exposure, so that each shift was assigned as either night (highest priority), evening or day (lowest priority). Using the work shifts, we calculated the working-hour characteristics of three major working-hour domains for 28 days: the length of working hours, that is weekly or daily working hours; time of day, that is proportion of work shifts; and shift intensity, that is the consecutive work shifts and recovery time between the shifts (Härmä, Karhula, Puttonen, et al., 2018; Härmä, Ropponen, Hakola, Koskinen, Vanttola, et al., 2015). Furthermore, we used cutoff points (>25%) based on earlier recommendations (for extended work weeks: >40 hr and >48 hr) and quick returns (<11 hr) (Härmä, Hakola, Ropponen, & Puttonen, 2015a), and ≥4 shifts and ≥2 shifts for consecutive evening or night shifts (Härmä, Hakola, et al., 2015; Ropponen et al., 2019).

2.3 | Statistical analyses

We used employee-level data from the employers' working time records for a case-crossover design with each employee representing a matched set of data for both the case and control exposure windows (Maclure & Mittleman, 2000; Mittleman, Maclure, & Robins, 1995). With this design, we compared the working-hour characteristics for the 28-day case exposure window immediately prior to the onset of a short sickness absence and for the case–control window (also 28 days prior to beginning of case exposure window). The case exposure and control windows were selected based on the earlier experiences of a similar data set (Ropponen et al., 2019).

The statistical analyses utilized first one-way analysis of variance (ANOVA) to compare age group differences of means in the control windows only. The post hoc comparison was done using the Bonferroni test. Then, we applied conditional logistic regression models for the risk of first incidence of short sickness absence in comparison of the case exposure and control windows for odds ratios (OR) and 95% confidence intervals (95% CI). We controlled the weekly working hours in the analyses of all other working-hour characteristics. Stata MP version 15.1 (StataCorp.) was used for the analyses.

3 | RESULTS

The mean age of the final sample was 39.7 years (standard deviation, [*SD*] 12.3) at the time of first incident short sickness absence. Table 1 presents the descriptive characteristics of working hours

TABLE 2 Means (with standard deviation, *SD*) of working-hour characteristics in control window among women for comparison between age groups

Working-hour characteristics	Shift work (n = 12,761)														
	≤25 years (n = 2,618)			>25 and ≤35 years (n = 3,183)			>35 and ≤45 years (n = 2,470)			>45 and ≤ 55 years (n = 2,624)			>55 years (n = 1,341)		
	Control window			Control window			Control window			Control window			Control window		
	mean	*SD*	p^a	mean	*SD*	p^b	Mean	*SD*	p^c	Mean	*SD*	p^d	Mean	*SD*	p^e
Length of working hours															
Daily working hours (hr)	8.2	0.9	.109	8.4	1.1	<.001	8.3	1.0	.790	8.2	0.9	<.001	8.1	0.9	<.001
Weekly working hours (hr)	30.2	6.9	<.001	28.1	8.5	<.001	26.9	8.7	1.00	27.3	8.8	<.001	25.7	9.3	<.001
>40-hr weeks of all working weeks	20	20	<.001	18	20	<.001	15	19	.005	17	19	<.001	14	18	<.001
>48-hr weeks of all working weeks	5	11	<.00	5	11	<.001	4	10	1.00	4	10	.003	3	8	<.001
>12-hr shifts	4	11	.082	5	15	.011	4	13	<.001	3	11	.032	2	8	<.001
Time of day															
Morning shifts	54	22	<.001	56	27	.001	57	28	.503	57	26	1.00	55	25	<.001
Day shifts	11	18	<.001	9	17	<.001	13	21	1.00	15	22	<.001	19	24	<.001
Evening shifts	23	19	<.001	20	19	<.001	17	19	1.00	18	19	.470	17	20	<.001
Night shifts	12	15	1.00	14	20	.002	13	22	<.001	11	21	.009	9	20	<.001
Shift intensity															
Quick returns	22	16	<.001	19	17	<.001	18	18	.757	19	18	<.001	21	20	<.001
Number of consecutive shifts	2.4	0.9	<.001	2.2	0.9	<.001	2.1	0.9	1.00	2.1	0.9	1.00	2.0	0.9	<.001

Note: Bonferroni post hoc test:
[a]Between ≤25 years and >25 and ≤35 years,
[b]Between >25 and ≤35 years and <35 and ≤45 years,
[c]Between <35 and ≤45 years and >45 and ≤55 years,
[d]Between >45 and ≤55 years and >55 years, and
[e]Between all groups.

TABLE 3 Conditional logistic regression (odds ratios, OR, with 95% confidence intervals, CI) for associations between working-hour characteristics (28-day case exposure and 28-day control windows) and first incidence of short sickness absence while controlling for weekly working hours

Working-hour characteristics	Shift work (*n* = 12,761)									
	≤25 years (*n* = 2,618)		>25 and ≤35 years (*n* = 3,183)		>35 and ≤45 years (*n* = 2,470)		>45 and ≤55 years (*n* = 2,624)		>55 years (*n* = 1,341)	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Length of working hours										
Daily working hours (hr)	**1.14**	**1.00, 1.30**	1.00	0.90, 1.12	1.12	0.99, 1.29	**1.17**	**1.00, 1.35**	1.09	0.89, 1.36
Weekly working hours (hr)	**1.03**	**1.01, 1.04**	**1.03**	**1.02, 1.03**	**1.02**	**1.02, 1.03**	**1.02**	**1.01, 1.03**	**1.02**	**1.01, 1.03**
>40-hr weeks of all work weeks (%)	1.00	1.00, 1.00	1.00	1.00, 1.00	1.00	1.00, 1.00	1.00	0.99, 1.00	**1.01**	**1.00, 1.01**
>48-hr weeks of all work weeks (%)	1.00	0.99, 1.00	0.99	0.99, 1.00	1.00	0.99, 1.00	1.00	0.99, 1.01	1.00	0.99, 1.01
>12-hr shifts	**1.01**	**1.00, 1.02**	1.00	1.00, 1.01	1.00	0.99, 1.01	1.01	0.99, 1.02	1.00	0.98, 1.02
Time of day										
Morning shifts (%)	1.00	0.99, 1.00	1.00	1.00, 1.00	1.00	0.99, 1.00	1.00	1.00, 1.01	**1.01**	**1.00, 1.02**
Day shifts (%)	0.99	0.98, 1.00	**1.01**	**1.00, 1.01**	1.00	1.00, 1.01	1.00	0.99, 1.00	1.00	1.00, 1.01
Evening shifts (%)	**1.01**	**1.00, 1.01**	1.00	0.99, 1.00	1.00	1.00, 1.01	1.00	0.99, 1.00	0.99	0.98, 1.00
Night shifts (%)	1.00	1.00, 1.01	1.00	0.99, 1.00	1.00	1.00, 1.01	1.00	1.00, 1.01	0.99	0.98, 1.00
Shift intensity										
Quick returns	1.00	1.00, 1.01	1.00	0.99, 1.00	1.00	0.99, 1.00	1.00	0.99, 1.00	1.00	0.99, 1.01
Number of consecutive shifts	0.95	0.83, 1.07	**0.84**	**0.74, 0.96**	0.88	0.76, 1.02	1.01	0.87, 1.16	0.96	0.79, 1.18
Number of consecutive evening shifts ≥4 shifts	-	na	-	na	-	na	-	na	-	na
Number of consecutive evening shifts ≥2 shifts	0.65	0.26, 1.62	0.95	0.41, 2.20	5.12	0.93, 28.07	3.11	0.89, 10.94	0.74	0.15, 3.70
Number of consecutive night shifts ≥4 shifts	-	na	-	na	-	na	-	na	-	na
Number of consecutive night shifts ≥2 shifts	1.22	0.66, 2.26	1.05	0.63, 1.75	1.19	0.63, 2.28	0.78	0.38, 1.61	0.95	0.26, 3.50

Note: na = not able to be assessed due to small number of employees.
Significant associations are in bold.

among those women in shift work being comparable in the exposure and control windows.

Based on the working-hour characteristics in the control window without sickness absence, there were systematic differences in the working-hour characteristics according to age, $p < .001$ (Table 2). Younger subjects had in general longer working hours, more night shifts and more consecutive evening and night shifts. However, the number of quick returns (<11 hr between the shifts) did not vary according to age. Comparisons of age groups indicated that middle-age groups (>35 and ≤45 years vs. >45 and ≤55 years) did not differ for most of the working-hour characteristics, whereas all other groups did (Table 2).

Weekly working hours showed consistent association with short sickness absence across all age groups (Table 3). We therefore chose to adjust all other working-hour characteristics for weekly working hours. As regards working-hour characteristics, we did not detect clear age-related differences in the associations of working-hour characteristics with short sickness absence (Table 3). Among the oldest age group (>55 years of age), percentage of >40-hr weeks of all work weeks and percentage of morning shifts showed a trend towards increased risk of short sickness absence (OR 1.01), whereas the number of consecutive shifts predicted lower risk (OR: 0.84) in the youngest age group (25–35 years of age). Length of daily working hours was associated with increased risk among especially the youngest (≤25 years) and middle-age (>45 years and ≤55 years) groups (OR: 1.14–1.17). The cut-off points for working-hour characteristics, that is >25% and for quick returns (Table 4), indicated few associations between working hours and short sickness absence in different age groups.

TABLE 4 Conditional logistic regression (odds ratios, OR, with 95% confidence intervals, CI) for associations between working-hour characteristic thresholds (28-day case exposure and 28-day control windows) and first incidence of short sickness absence while controlling for weekly working hours

Working-hour characteristics thresholds	Shift work (*n* = 12,761)									
	≤25 years (*n* = 2,618)		>25 and ≤35 years (*n* = 3,183)		>35 and ≤45 years (*n* = 2,470)		>45 and ≤55 years (*n* = 2,624)		>55 years (*n* = 1,341)	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
>25% >40-hr weeks of all work weeks	0.98	0.85, 1.15	1.11	0.95, 1.29	0.96	0.80, 1.16	0.94	0.79, 1.12	1.10	0.83, 1.45
>25% >48-hr weeks of all work weeks	0.77	0.51, 1.16	0.75	0.50, 1.12	0.83	0.49, 1.41	0.87	0.50, 1.50	0.97	0.40, 2.37
>25% evening shifts of all shifts	1.12	0.95, 1.31	0.98	0.84, 1.15	1.08	0.89, 1.31	0.85	0.70, 1.03	0.85	0.63, 1.13
>25% night shifts of all shifts	1.17	0.98, 1.41	1.02	0.86, 1.21	1.01	0.81, 1.24	1.05	0.83, 1.33	0.73	0.48, 1.10
>25% quick returns of all shift intervals	1.03	0.90, 1.18	0.98	0.85, 1.12	1.00	0.85, 1.17	**0.83**	**0.71, 0.98**	1.07	0.85, 1.35
0–1 quick returns/28 days	0.89	0.75, 1.06	1.08	0.92, 1.27	1.03	0.86, 1.23	0.99	0.83, 1.19	**0.69**	**0.52, 0.91**
2–4 quick returns/28 days	1.11	0.98, 1.26	0.96	0.85, 1.09	0.99	0.85, 1.13	1.02	0.89, 1.17	1.18	0.97, 1.42
5–11 quick returns/28 days	0.92	0.77, 1.09	0.98	0.82, 1.18	1.01	0.80, 1.26	0.97	0.80, 1.19	1.06	0.81, 1.38

Note: na = not able to be assessed due to small number of employees.
Significant associations are in bold.

4 | DISCUSSION

This relatively large prospective study of almost 13,000 women at hospital work aimed to clarify potential age group differences in objective working hours and whether the association of objective working-hour characteristics with short (1–3 days) sickness absence changes according to age. The use of objective working-hour data within 28 days preceding short sickness absence and utilization of case-crossover design enabled us to control several factors potentially influencing the associations of working-hour characteristics and short sickness absence, such as organisation, work culture and environment. Although shift work and ageing may be associated with higher risk for long sickness absence as shown in an earlier study based on partially the same data but also by others (Ropponen et al., 2019; Ticharwa et al., 2019), our results suggest that age does not directly affect the association of specific working-hour characteristics with short sickness absence. An additional finding for practical significance was that strenuous working time characteristics are less frequent among the ageing confirming our hypothesis.

This study may be among the first to shed light to age group differences in associations between shift work and short sickness absences. These findings confirm the earlier results without age group stratification and based on partially the same data set in which shift work was evaluated based on the work contract (Ropponen et al., 2019) and also findings from the UK (Dall'Ora et al., 2018). Earlier studies that have showed association with risk of sickness absence due to long working hours have focused on one hospital only or on more limited age range without assessing age groups (Bernstrom, 2018; Dall'Ora et al., 2018). Our finding of extended weekly working hours (>40-hr weeks) could be a factor to be concerned for those planning working time at hospital work for workers >55 years of age. However, due to low increase in risk, this should be interpreted with caution and further studies would be needed to confirm this. Thus, our results of extended weekly working hours might also reflect some of the earlier results which either have not find any association or the direction of association has been opposite (van Drongelen, Boot, Hlobil, Beek, & Smid, 2017; Vedaa et al., 2017). Instead, quick returns (<11 hr between two consecutive work shifts) were associated with sickness absence only among the oldest age group, giving further support to the assumption in our hypothesis that since ageing is associated with increased need for recovery (Jansen, Kant, & Brandt, 2002), younger and older workers may react differently to insufficient time between the shifts (Cai et al., 2019; Stock et al., 2019).

Our objective working-hour data and utilizing the limits described in detail earlier enabled us to identify those women who worked specific shifts (Härmä et al., 2017). Extended weekly working hours and quick returns were associated with the risk of short sickness absence among the oldest age group (>55 years of age). These might reflect aspects related to recovery (Åkerstedt et al., 2017) but also acclimation to night work (Haus & Smolensky, 2013). We focused on short sickness absences (i.e. 1–3 days usually available by self-reports) since we expected them to reflect difficulties to recover that can be due to sleep debt, fatigue or poor detachment from work (Boschman, Noor, Sluiter, & Hagberg, 2017; Marmot et al., 1995; Vedaa et al., 2017). However, these short absences can also be a form of self-control over working times to support recovery (Ala-Mursula, Vahtera, Kivimäki, Kevin, & Pentti, 2002). Hence, we assume that especially older employees need individual flexibility and modifications in their work time planning. This may have been the case among current shift working women, since the results showed significant changes in direction of less strenuous working-hour characteristics with higher age. Alternatively, this finding might be related to work task change when entering seniority at the work (Oakman, Neupane, Proper, Kinsman, & Nygard, 2018), or an employee can be promoted to become a manager. The finding can also be related to health issues and associated changes in work shifts (i.e. moving from shift work to day work) (Hakola & Harma, 2001; Härmä, Karhula, Ropponen, et al., 2018).

This study had the strength of using objective working-hour data without memory bias, attrition or selection based on exposure for almost 13 000 employees working in hospitals. Such data are existing in other cohorts (Dall'Ora et al., 2018; Vedaa, Pallesen, et al., 2019; Vedaa et al., 2017), but rare studies have focused on short (1–3 days) sickness absences as we have done in an earlier study based on partially the same data set but in which shift work was evaluated by work contract and data were from 2008 to 2015 (Ropponen et al., 2019). We had no loss to follow-up and a specific strength was the possibility to objectively identify those who work shifts and night shifts. As many earlier studies have relied on self-reported (Åkerstedt et al., 2017; Catano & Bissonnette, 2014) or work contract information (Ropponen et al., 2019) for shift work patterns, there is a possibility for misclassification which means that also day workers could be included in the analyses of shift workers. The study sample of women restricts the generalizability to men, and we had only one occupation sector, health and social care without possibility to investigate other sectors. Although we had a relatively large sample, the stratification to age groups resulted lack or low number of some working-hour characteristics. Hence, even larger sample size is needed to shed further light to importance of consecutive evening or night shifts on short sickness absences. Furthermore, based on recent findings in Nordic countries, the working-hour characteristics are known to vary between countries which may limit the generalizability to other countries (Garde et al., 2019). However, the general finding of ageing employees being more affected by certain working-hour characteristics could merit further studies in other countries and studies on longer and diagnosis-specific sickness absence. In general, short sickness absences predict longer sickness absences (Hultin, Lindholm, Malfert, & Moller, 2012; Laaksonen, He, & Pitkaniemi, 2013) and the risk of permanent work incapacity in terms of disability pension rises along age (Ropponen et al., 2011).

5 | CONCLUSIONS

Older employees had shorter working hours and less night and consecutive shifts. Working-hour characteristics associated with the length of working hours showed minor associations with short sickness absence across all age groups of the shift working women. Also, extended (>40 hr) weekly working hours and the number of short (<11 hr) quick returns were linked, although in small magnitude, with short sickness absences among the older age groups. Altogether these working-hour characteristics should be acknowledged in shift scheduling especially among older employees.

ETHICAL APPROVAL

The FPS study was approved by the ethics committee of the Hospital District of Helsinki and Uusimaa, Finland (HUS; HUS 1210/2016).

ORCID

Annina Ropponen https://orcid.org/0000-0003-3031-5823

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