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We combined objective working hour data with surveys on physical activity over 17 years. Compared with day work, shift work without night shifts was associated with physical inactivity among men, whereas shift work with night shifts was negatively associated with physical inactivity among women and white-collar workers. Having small children was a risk factor for physical inactivity among shift workers.

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Shift work and physical inactivity: findings from the Finnish Public Sector Study with objective working hour data

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Objectives Shift work is a risk factor for chronic diseases, and physical inactivity can have an influence on this association. We examined whether intra-individual changes in working time characteristics were associated with changes in physical inactivity and examined the risk factors for physical inactivity among shift workers in a 17-year longitudinal study cohort.

Methods Study participants were 95 177 employees from the Finnish public sector. Work schedule information was based on questionnaire responses and additional register-based working time characteristics for 26 042 employees. The associations between working time characteristics and physical inactivity were examined using a fixed-effects logistic model. To investigate the risk factors for physical inactivity among shift workers, the odds ratios (OR) of worktime control and having small children were calculated.

Results Compared with day work, shift work without night shifts was associated with physical inactivity among men [OR 1.38, 95% confidence interval (CI) 1.09–1.74], whereas shift work with night shifts was negatively associated with physical inactivity among women (OR 0.85, 95% CI 0.76–0.96). Register-based working time data confirmed that workers with a higher percentage of night shifts had a lower risk of physical inactivity. Having small children was associated with physical inactivity among shift workers (OR 1.47, 95% CI 1.32–1.65).

Conclusions Both survey and objective working hour data revealed that workers having work schedules with night shifts were more likely to be physically active. Having small children was a risk factor for physical inactivity among shift workers.

Key terms Finland; fixed effect; fixed-effects modeling; leisure-time physical activity; longitudinal study; physical activity; shift worker; work schedule; working time.

Shift work is associated with sleep disturbances, stroke, breast cancer, and several chronic diseases such as cardiovascular diseases and metabolic diseases (1). Lack of physical activity has been shown to be a direct risk factor for cardiovascular and metabolic diseases (2); therefore, physical activity is recommended for shift workers. Because shift work is often necessary in the modern workplace, strategies aiming to attenuate its adverse health effects have been tested (3). Systematic reviews have determined that physical activity-based interventions improved the body composition and sleep of shift workers (4, 5). It has also been suggested that shift workers engage in less physical activity compared with day workers because they have difficulty participating in group-based physical activities or activities in the early evening (6). However, evidence regarding the association between shift work and physical inactivity is inconsistent.

Several cross-sectional studies have reported an association between shift work and less engagement in leisure-time physical activity (7–9), whereas others have found either no (10–13) or a negative (14–16) association. Longitudinal studies are scarce; no association between 1-year changes in work schedule and changes

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in physical activity was discerned in one (17). Another longitudinal study determined that a long history of night work was associated with more vigorous physical activity among female workers (18). The same study also determined that "never" and "ever" night workers differed significantly in socioeconomic status and health behaviors. Therefore, in cross-sectional studies, the difference observed in the physical activity between day and night workers was likely to have been confounded by participants' personal characteristics. Lately, several studies utilizing objective measurement of physical activity documented no association between shift work and total leisure-time physical activity (19–22).

Variations in measurement methods and definitions of work schedule have led to contrasting results between studies as well. Workers with rotating or fixed shifts, as well as those with shift work with or without night shifts, are usually categorized in the "shift work group" even though they may exhibit different levels of physical activity. For example, physical activity was found to be positively associated with irregularly rotating shifts, but negatively associated with fixed night work (21). Objective quantification of working time characteristics has rarely been used, with the exception of one study of police officers that revealed increased vigorous physical activity in shift workers (16). Apart from shift work, highly physical manual work may prevent individuals from desiring to engage in physical activity after work (9, 10) and workers of lower socioeconomic status may not have the physical resources to engage in strenuous physical activity after working hours (23). Furthermore, participants in previous studies were recruited from different genders and occupational groups in which the associations between shift work and physical activity differ. In Finnish cohorts, women have generally exhibited less physical activity (23–25), but gender interaction in the association between shift work and physical activity has not been examined.

To increase physical activity among shift workers, barriers related to work and family conditions should be taken into account. Working time control refers to autonomy with regard to work time (26) and has been found to be lower among shift workers compared to dayworkers (27–29). Furthermore, having small children was associated with physical inactivity in one study (11) but not in another study that adjusted for marital status (10). Nevertheless, none of these risk factors for physical inactivity have been examined in longitudinal studies.

In summary, previous studies on the associations between shift work and physical activity have tended to lack detailed information concerning characteristics of working hours and have been based on limited sample sizes and a cross-sectional design, which is vulnerable to selection bias and reverse causal relationships. To address these limitations, we used a large longitudinal cohort from the Finnish Public Sector (FPS) Study to examine the associations between intra-individual changes in shift schedule and changes in physical activity. We further linked the survey data with objective registry data of daily working hours to examine the associations between the more specific working hour characteristics and physical inactivity. To identify risk factors for physical inactivity among shift workers, we examined the associations between changes in physical activity and changes in family and work conditions with fixed-effects models.

Methods

Study participants

Data from two cohorts of the FPS Study were used. In the first cohort, information on exposure to shift work was based on 2000–2017 survey information (referred as the "survey cohort"). In the other cohort, information regarding exposure to shift work was based on 2007–2017 registry data (referred as the "register cohort"; figure 1). The FPS Study comprises two parts (i): the 10-Town Study, a study of local government employees in 11 towns, and (ii) the Work and Health in Finnish Hospital Personnel Study, a study conducted within 21 hospitals. We used six waves of survey information from the FPS Study: 2000, 2004, 2008, 2012, 2014, and 2016 from the 10-Town Study and 2000, 2004, 2008, 2012, 2015, and 2017 from the Work and Health in Finnish Hospital Personnel Study. Therefore, we obtained information regarding physical activity for six consecutive time points, and this information was linked to information on exposure to shift work attained from the same survey (the survey cohort) or to registry data of working hour characteristics of the preceding year (for the last four time points only; the register cohort). The response rates of the six waves of the survey were 67–72%. The Ethics Committee of the Hospital District of Helsinki and Uusimaa (HUS) approved the FPS Study (HUS 1210/2016).

A total of 149 303 participants participated in at least one of the survey waves. To examine changes in physical activity over time, only those who had participated in at least two surveys (N=96 651) were included in the survey cohort. The largest occupational groups in the survey cohort were practical nurses (20%), registered nurses (15%), primary school and preschool teachers (8%), and secondary school teachers (6%).

The registry data of working hours of the register cohort were obtained from Titania® shift-scheduling software, which was used by the hospital workers of the FPS Study cohort (including the whole shift-working

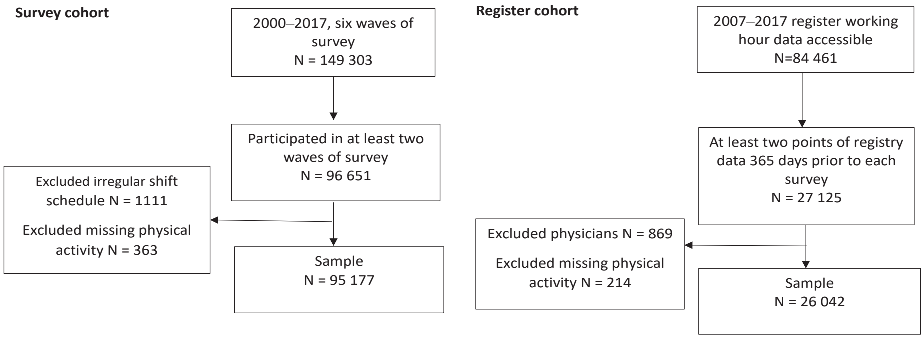

Figure 1. Selection of study participants from the Finnish Public Sector Study for the survey and register cohorts.

population and the majority of the day-working population of all the studied hospitals) during the period of 2007–2017. We included only workers who had at least 150 shifts and 300 contract days during the preceding 365 days and those having participated in at least two surveys. Finally, 869 physicians were excluded because their on-call data were not available, whereas nonphysician workers did not have on-call work, and all their working hours were recorded in the registry data. Another 214 employees were excluded due to missing physical activity data, leaving a total of 26 042 participants in the register cohort (figure 1). The main occupational groups in the register cohort were registered nurses (35%) and practical nurses (33%).

Assessment of shift work and working time

Participants in the survey cohort were classified as day workers, shift workers without night shifts, shift workers with night shifts, and fixed night workers on the basis of the survey data. In the 10-Town Study, participants in the 2000 and 2004 waves were asked "Is your work regular day work?". If the answer was negative, they were then asked to indicate if their work included evening, night, or weekend shifts. Participants were classified as (i) day workers if they answered "yes" to the initial question, (ii) shift workers without night shifts if they answered "no" to the initial question and then indicated that their work included evening shifts but not night shifts, or (iii) shift workers with night shifts if they indicated having both evening and night shifts. Participants selecting any other combination of responses were excluded from the analyses. In the 2008 and later waves of the 10-Town Study and all waves of the Work and Health in Finnish Hospital Personnel Study, participants were classified according to whether they described their current work as either day work, shift work without night shifts, shift work with night shifts, fixed night work, or other irregular work. Participants who had another irregular work schedule were excluded. Finally, participants with invalid or missing values on shift schedule (N=1111) and physical activity (N=363) were excluded from the survey cohort, leaving a total of 95 177 participants in the survey cohort (figure 1). The questionnaire items used have been validated against the registry data of working hours (registry data) (30).

The registry data of daily working hours of the register cohort for 365 days prior to each survey were used. On the basis of the daily start and end times of the shifts, several working hour characteristics were calculated on the basis of the main dimensions of the working hours (length, timing, recovery, and social aspects), as in previous studies (30–32). The variables used in this study were average weekly working hours, the percentage of evening shifts and night shifts, percentage of quick returns (<11-hour shift interval) of all shift intervals, percentage of single free days of all the free days, percentage of >48-hour weeks, and percentage of long shifts (≥12 hours) (31). We selected these working hour characteristics on the basis of the hypothesis that length of working hours, timing of work shifts, and time for recovery could influence the possibility of or access to leisure time physical activity. According to the distribution of working hour variables (supplementary table S1, www.sjweh.fi/show_abstract.php?abstract_id=3868) and the literature (33), the working hour variables were dichotomized using a cutoff of >10% for >48-hour weeks, long shifts, and night shifts, and >25% for the other variables.

Assessment of physical inactivity

In all six survey data waves, participants were asked how many hours of physical activity they had per week on average during leisure time or commuting within the past year. The options were: 0, <30 minutes, 0.5–1, 2–3, and ≥4 hours. They indicated hours for each of the four physical activities or activities with similar intensity: walking, brisk walking, jogging, and running. The participants were categorized as being physically inactive if they reported brisk walking, jogging, or running for <30 minutes per week (34–36), otherwise, they were categorized as being physically active. Those who reported only walking were categorized as physically inactive as well (34–36). We also analyzed whether the participants were lacking in vigorous physical activity, defined as having <30 minutes of jogging, running, or physical activities with similar intensity each week.

Other variables

Age, gender, occupation, having small children (<6 years old), worktime control, and weekly working hours were self-reported in the survey questionnaire. The worktime control was measured using seven questions (i): control over length of day, (ii) control over the beginning and end of a workday, (iii) opportunities to take breaks, (iv) opportunities to deal with private matters during the workday, (v) control over scheduling of shifts, (vi) control over scheduling of paid days off and vacations, and (vii) opportunities to take unpaid leave (37). Responses to each item were given on a 5-point scale ranging from very little (score 1) to very much (score 5). The mean of overall worktime control, control over daily hours (items i and ii), and control over time off (items iii–vii) were divided into tertiles as high, intermediate, and low worktime control (28).

Participants were categorized as blue- or white-collar workers according to self-reported occupations, using the first digit of their occupational code in the Finnish National Classification of Occupations 2001 (38). Legislators, managers, professionals, technicians, clerks, and service and sales workers were categorized as white-collar workers. Agricultural and fishery workers, craft workers, machine operators and assemblers, and elementary occupations were categorized as blue-collar workers.

Due to changes in the questionnaire over the six survey waves, data regarding having small children were absent in the 2014 survey, and 24%–45% of responses were missing in the other surveys. Self-reported working hours were available only in the 2000–2015 Work and Health in Finnish Hospital Personnel Study, and worktime control was not surveyed in the 2000–2008 Work and Health in Finnish Hospital Personnel Study. A dummy category was created for missing values in logistic models to avoid sample exclusion by the statistical software. In the statistical analysis of the register cohort, weekly working hours were retrieved from the registry data.

Statistical analysis

The distribution of baseline age, gender, physical inactivity, working hours, work time control, and having small children was examined separately in the survey and register cohorts. The difference between baseline characteristics according to work schedule was examined using chi-square tests and analysis of variance. Post hoc pairwise comparisons using Tukey's procedure for continuous variables and Bonferroni correction for categorical variables were performed.

The fixed-effects logistic model was used to examine the longitudinal dataset for associations between changes in work schedule and changes in physical inactivity during the survey period. Participants who exhibited changes in the outcome (physical inactivity) in at least two waves of the survey were considered informative and were included in the analysis. The longitudinal fixed effects model is advantageous because time-independent known and unknown confounders are eliminated when the intra-individual changes over time are examined (39). Therefore, the study participants served as their own controls. The survey cohort was stratified by gender and occupations to examine associations between different genders and occupational groups (blue-collar and white-collar). To control the time-variant confounders, we added weekly working hours, having small children, and worktime control to the adjusted models. To examine risk factors for physical inactivity among shift workers in the survey cohort (shift work with and without night shifts and fixed night workers, N=29 019), we examined associations between changes in physical inactivity and changes in having small children, worktime control, and working hours with fixed effects models. SAS 9.4 (SAS Institute, Cary, NC, USA) was used for the analyses. The significance level was set at $P<0.05$.

Results

According to the first survey available for each participant in the survey cohort, 77 250 (81.2%) employees were women and 15 488 (16.3%) were physically inactive. Shift workers with night shifts were younger than workers in the other groups (table 1). Shift workers without night shifts reported the highest percentage of physical inactivity (19.1%) of the four work schedule groups. The post hoc analysis revealed that physical inactivity, having small children, working hours, and worktime control scores differed significantly between workers with day work, shift work without night shifts, and shift work with night shifts. A higher percentage of workers with shift work without night shifts lacked vigorous physical activity than workers with other shift schedules. According to the crude longitudinal fixed effects logistic model, compared with day work (table 2), shift work with night shifts was negatively associated with physical inactivity [odds ratio (OR) 0.88, 95% confidence interval (CI) 0.79–0.98). In the adjusted model, the association remained significant (OR 0.89, 95% CI 0.80–0.99). After

Table 1. Baseline demographics and physical inactivity in the survey and register cohorts. [SD=standard deviation.]

	Survey cohort (N=95 177) [a]																Register cohort (N=26 042)			
	Regular day work (N=66 158)				Shift work without night shifts (N=13 498)				Shift work with night shifts (N=14 676)				Fixed night work (N=845)							
	N	%	Mean	SD	N	%	Mean	SD	N	%	Mean	SD	N	%	Mean	SD	N	%	Mean	SD
Age (years)																				
≤39	22 492	34.0			4580	33.9			7399	50.4			330	39.1			8175	31.4		
40–49	22 792	34.5			4442	32.9			4517	30.8			294	34.8			7923	30.4		
≥50	20 874	31.6			4476	33.2			2760	18.8			221	26.2			9944	38.2		
Gender (women)	52 951	80.0			11 665	86.4			11 930	81.3			704	83.3			24 165	92.8		
Physical inactivity	10 731	16.2			2573	19.1			2049	14.0			135	16.0			4456	17.1		
Lack of vigorous physical activity	34 347	55.2			8183	64.8			7613	54.9			430	55.6			14 961	60.6		
Having small children	11 441	17.3			2176	16.1			3209	21.9			145	17.2			3204	12.3		
Weekly working hours [b]			39.77	7.7			39.98	7.4			38.31	6.9			41.70	9.7			34.26	3.8
Worktime control scores			2.78	0.9			2.71	0.8			2.58	0.7			2.75	0.7			2.80	0.7

[a] In the survey cohort, all the listed variables are significantly different between the four shift schedules (P<0.001, chi-squared tests and analysis of variance).
[b] Weekly working hours were self-reported in the survey cohort and were retrieved from register working time data in the register cohort.

Table 2. Odds ratios (OR) and confidence intervals (CI) for the association of work schedule with physical inactivity in the survey cohort based on longitudinal fixed effects model, stratified by gender and occupation.

	All (N=22 122) [a]		Men (N=4135)	Women (N=17 987)	White-collar (N=19 047)	Blue-collar (N=2589)
	Crude model	Adjusted model [b]	Crude model	Adjusted model [b]	Crude model	Adjusted model [b]
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Work schedule						
Day work	1	1	1	1	1	1
Shift work without night shifts	0.97 (0.90–1.05)	0.97 (0.89–1.05)	1.38 (1.09–1.74) [c]	0.92 (0.84–1.00)	0.97 (0.88– 1.06)	1.00 (0.81–1.23)
Shift work with night shifts	0.88 (0.79–0.98) [c]	0.89 (0.81–0.99) [c]	1.13 (0.87–1.47)	0.85 (0.76–0.96) [c]	0.86 (0.77– 0.97) [c]	1.26 (0.88–1.80)
Fixed night work	1.07 (0.86–1.34)	1.11 (0.89–1.39)	1.33 (0.76–2.34)	1.08 (0.84–1.38)	1.09 (0.86–1.39)	1.36 (0.63–2.93)

[a] The number of participants who had changes in physical inactivity between any two waves of survey during 17-year follow-up.
[b] Adjusted for working hours, having small children, and worktime control.
[c] P<0.05.

stratification by gender and occupation, the association was significant only among women (OR 0.85, 95% CI 0.76–0.96) and white-collar workers (OR 0.86, 95% CI 0.77–0.97). Among men, a positive association between shift work without night shifts and physical inactivity was observed (OR 1.38, 95% CI 1.09–1.74). Compared with day work, shift work with or without night shifts and fixed night work were not significantly associated with lack of vigorous physical activity.

In the register cohort, 24 165 (92.8%) employees were women and 4456 (17.1%) were physically inactive. Based on the adjusted model, a high percentage of night shifts was negatively associated with physical inactivity (OR 0.84, 95% CI 0.72–0.98) (table 3). The association was no longer significant when the study participants were restricted to shift workers (OR 0.87, 95% CI 0.73–1.03). Other objective working time characteristics were not associated with physical inactivity, and no working time characteristic was associated with lack of vigorous activity either.

Table 4 displays the OR of intra-individual changes in worktime control, working hours, and having small children for physical inactivity among shift workers. For worktime control variable components, control over time off was included in the models because it is more relevant for shift workers than control over daily hours. In the adjusted model, having small children remained significantly associated with physical inactivity in shift work (OR 1.47, 95% CI 1.32–1.65).

Discussion

Based on analysis of this extensive body of prospective data, this study determined that shift work with night shifts was associated with more physical activity, but the association is restricted to women and white-collar workers. Changes in objective working time characteristics were not associated with changes in physical inactivity among shift workers. Having small children was associated with physical inactivity among shift workers.

The finding that shift work with night shifts was associated with more leisure-time physical activity,

Table 3. Odds ratios (OR) and confidence intervals (CI) for the association of register-based shift characteristics with physical inactivity in the register cohort based on a longitudinal fixed-effects model, adjusted for the time-varying confounders (working hours, having small children, and worktime control).

Working time characteristics	Cut point (%) [a]	All (N=26 042)			Shift workers (N=15 849)		
		N	OR	95% CI	N	OR	95% CI
>48 hour work weeks of all work weeks	10	5237	1.03	0.88–1.22	2961	1.06	0.89–1.26
Quick returns of all shift intervals	25	5237	0.91	0.78–1.04	2961	0.93	0.80–1.08
Single days off of all day off-periods	25	4782	0.99	0.87–1.13	2876	0.92	0.80–1.06
Evening shifts of all shifts	25	5237	1.07	0.94–1.23	2961	1.10	0.94–1.28
Night shifts of all shifts	10	5237	0.84	0.72–0.98 [b]	2961	0.87	0.73–1.03
Long shifts of all shifts	10	5237	0.93	0.17–1.22	2961	0.88	0.65–1.17

[a] Working time characteristics (in percentage) were dichotomized by cutoff points into high and low levels.
[b] P<0.05.

Table 4. Time-variant risk factors for physical inactivity in shift workers (with or without night shifts and fixed night shifts, N=29 019), selected from the survey cohort.

	Shift workers (N=5558) [a]	
	Crude model [b]	Adjusted model [c]
Survey waves		
1st	1	1
2nd	1.11 (1.00–1.23) [d]	1.14 (1.03–1.27) [d]
3rd	1.37 (1.23–1.54)	1.45 (1.30–1,63)
4th	1.90 (1.69–2.14) [d]	2.03 (1.80–2.29) [d]
5th	1.84 (1.63–2.07) [d]	2.03 (1.75–2.36) [d]
6th	1.63 (1.43–1.85) [d]	1.70 (1.47–1.96) [d]
Control over time-off		
High	1	1
Intermediate	0.95 (0.85–1.06)	0.95 (0.85–1.06)
Low	0.96 (0.84–1.10)	0.96 (0.84–1.10)
Weekly working hours >40 (Reference: ≤40)	0.99 (0.98–1.00)	1.07 (0.87–1.33)
Having small children (Reference: 0)	1.46 (1.31–1.63) [d]	1.47 (1.32–1.65) [d]

[a] Number of participants with changes in physical inactivity between any two waves of the survey during the 17-year follow-up.
[b] Adjusted for survey wave.
[c] Adjusted for survey wave and all other listed variables.
[d] P<0.05.

especially light intensity activities, was consistent with a large-scale Dutch survey study (15) and two smaller studies (14, 16). Findings from our objective registry data that night shifts were associated with more physical activity in the whole register cohort but not among shift workers implies that working night shifts, generally, rather than working a high percentage of night shifts affects physical activity. A study by Loef et al (15) suggested that shift workers slept fewer hours and therefore had more time for light physical activity. However, a recent study using the same FPS Study cohort discovered that shift work with night shifts was associated with longer sleep duration (40). We suggest that engaging in shift work with night shifts allows workers to utilize free daytime hours and free weekdays, and their attendant superior daylight hours, to engage in physical activities.

The association between shift work with night shifts and physical activity was significant only among women and white-collar workers. In general, men have longer working hours, more non-day shifts, and less recovery time than women, and this was observed also in Finland (41). It is thus possible that men have a higher need for recovery from shift work than women (42, 43). On the other hand, it has been reported that men tend to drive to work, whereas women walk or cycle more frequently (44, 45). It is possible that women performed more light-to-moderate intensity exercise during their commutes. A Japanese study also demonstrated that female shift workers managed to maintain healthy lifestyles more effectively compared with male shift workers (46). Therefore, female shift workers may compensatorily increase physical activity when they work night shifts. Our findings also indicated that blue-collar workers did not display changes in physical activity when they changed between day and shift work, probably because they had a consistently low level of leisure-time activity compared with white-collar workers (9).

In this study, objective variables of shift intensity were not significantly associated with physical activity, although they were associated with fatigue and sleep in another study with the same cohort (32). This finding indicates that changes in physical activity occur more slowly than changes in sleep and fatigue; therefore, longer exposure may be needed to bring about changes in physical activity. Leisure-time physical activity may also be more responsive to work schedule changes than to shift intensity changes, and intra-individual variation of these shift intensity variables over time were relatively small in our study sample. A cross-industry or cross-nation comparison with larger variations in shift intensity might yield significant findings.

Consistent with previous studies, we also observed lower worktime control among shift workers compared with day workers (27, 28). Nevertheless, low worktime control was not associated with physical inactivity among shift workers, but having small children was. This finding is consistent with earlier discoveries that physical activity levels are lower among parents of small children, especially mothers (47). In addition, work–family conflict has been reported to be associated with shift work more often than with regular day work

(33, 48) and is associated with changing from shift work to day work (49). To encourage physical activity among shift workers and also to maintain the workforce, future studies should examine the barriers to engaging in physical activity among shift workers with young children.

A strength of this study is that it used an extensive longitudinal dataset that was collected over 17 years to examine the association between work schedule, working hour characteristics, and physical activity. The long follow-up period allowed us to investigate individual changes in health behavior along with changes in working schedules. The use of longitudinal fixed-effects models enabled us to minimize the selection bias that is commonly seen in shift work studies. Second, the use of objective data regarding working hours makes this study unique because it could analyze precise working hour information.

Nevertheless, this study has some limitations. First, physical activity was self-reported, rendering it vulnerable to participant interpretation and recall bias. In one study, workers were observed to over-report engaging in vigorous physical activities, especially workers with fatigue symptoms (50). Furthermore, shift workers who became ill during the follow-up tended to switch to day work (51) and became less physically active compared with the time before the illness. Therefore, the association between shift work and physical activity may have been overestimated in our study. Second, the study participants were Finnish workers from a female-dominated public sector with working conditions, including working hours and work–life balance, that could be more favorable than the work conditions in other sectors or countries (52). It is expected that in an industry or country with long working hours or high shift intensity, the association between shift work and physical activity may be different. The interpretation of the results of this study should thus be restricted to workplaces with normal working hours and societies with similar working times (53).

In conclusion, we discovered that changes in work schedule were slightly associated with changes in physical activity. The association depended on gender and occupation. Among women and white-collar workers, the shift work-related health risks are unlikely the result of decreased physical activity. On the contrary, shift workers may have elevated awareness of their health risks and may attempt to compensate for the health risks by increasing their physical activity. Nevertheless, shift workers with small children were found to be at higher risk of physical inactivity. Access to childcare services when parents work shifts, support for childcare from a spouse or other family members, and public resources that make engaging in physical activity easier for those with children would help promote physical activity among shift workers.

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Conflict of interest

The authors declare no conflicts of interest.

Reference

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