

Working hour characteristics in the Finnish retail sector – a registry study on objective working hour data

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Abstract: Earlier research is lacking on the prevalence and nature of objective working hour characteristics in the retail sector. We developed a codification in the retail sector and investigated differences in objective working hour characteristics by part-time work, sex and age. The payroll-based registry data of objective working hours consisted >12,000 employees of the retail sector in Finland for 2018–2020. Descriptive statistics for means, standard deviations (SD) and range of annual working hour characteristics were calculated, the differences in means were tested, partially based on the protocol established for health care sector. The final sample had 60–63% part-time employees and 23% men. Morning shifts were more frequent (48–51%) among full-time employees compared to 27–30% of the part-time employees. Evening shifts, 43–46%, were frequent among part-time employees vs. 26% in full-time. No sex differences were detected, and age group differences only among part-time employees. To conclude, the codification for registry-based working hour data enables us to identify individual differences in working hour characteristics. The working hour characteristics differed between part-time and full-time employees, not between sexes, whereas age differences were minor and among part-time employees. The codification could be used in studies of the retail sector in association with health and wellbeing.

Key words: Shift work, Working time, Retail sector, Part-time employees

Introduction

Today's 24/7 society includes many people who work night shifts or irregular working hours. At the European level, around 20% of the employees work in shifts¹. Night or irregular working hour arrangements are required for services e.g., in commerce and hospitality including the re-

tail sector where 50% of employees are women². Furthermore, the service sector in total (i.e., wholesale, retail trade and transportation, accommodation and food) is the largest (25%) employment sector in Europe³. Hence, due to the known importance of night work as a risk factor for increased fatigue and chronic diseases at least partially due to specific working hour characteristics in shift work (e.g., the length and timing of shifts), circadian dysrhythmia, and disturbed sleep, or due to the psychosocial or behavioural mechanisms^{4–7}, a specific need exists to define exposure to unfavourable working hours of retail sector.

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To date, a growing body of evidence exists on the detailed working hour characteristics in the health care sector, as well as on the association of the working hour characteristics with various health- and wellbeing related outcomes^{8–16}. For example, in the health care sector short intervals between the shifts are associated with increased risk of sickness absence^{10, 11} and occupational injuries⁸, and long spells of night shifts seem to increase the risk for long sickness absence⁹, and some chronic diseases like breast cancer¹⁷. However, research is lacking the prevalence and nature of similar, possible unfavourable working hour characteristics of the retail sector. Earlier studies of the retail sector, even being large and prospective, have relied on survey data of working hours hampering the evaluation of the detailed features of the working hours^{18, 19}. Questionnaire data on working hours is also prone to reporting bias^{20–23}. The retail sector resembles health care by being dominated by young women although the part-time work is more frequent^{24, 25}. Compared to men, women may be more sensitive to the effects of unsocial working hours on work-life balance due to their observed higher total working hours and differentiated social responsibilities^{26, 27}. Due to the important role of working hours in health and wellbeing, and the lack of earlier research on specific characteristics of working hours, an emerged need exists to investigate the more detailed features of the working hour characteristics of the retail sector.

The aim of this study was to describe the objective working hour characteristics in the retail sector based on an established protocol and to investigate if the working hours differ by part-time work, sex or age. Furthermore, we aimed to develop a working hour codification for future studies of objective working hours of the retail sector.

Subjects and Methods

The data was gathered as a part of the development of working hours in “RetailHours-project” that consists of three regions of the chain of companies of the retail sector in Finland. The regions were the capital area of Finland (N >11,000 employees), Central Finland (N >2,700) and North-East Finland (N >2,200). In total, this chain of companies has 900 stores across Finland and the RetailHours-project included 50% of them. The number of employees per store varied between 5 to 268 employees. The RetailHours-project had in total working hour data from 16,728 employees from March 6, 2017 to December 31, 2020. We present the data for 2018–2020 as they are comparable, i.e., included the full year. We excluded employees

working according to other service sector collective agreements and agency workers who were employed by other companies and were paid on an hourly basis due to their working hours not being planned for retail stores. Hence the final sample (n=13,876) included employees working according to the collective agreement of the commercial sector with working hours planned for retail stores. The data comprised of employer owned employment information why no ethical approval was required for the study.

Working hour characteristics

The payroll-based employer’s owned registry data of daily working hours were retrieved from the shift scheduling program Ortec Workforce Scheduling (Elli)-program. The working hour data included the starting and ending times of the daily working hours and the different reasons for an absence (day off, sick leave, annual leave, etc.). The data also included information on age, sex, work contract type, work unit, and regions. Furthermore, data included whether an employee had a part-time or full-time work contract. In Finland, full-time work in the retail sector includes those who have a work contract for working hours 37.5 hours/week and those with part-time work have working hours <37.5 hours/week based on individual agreements. For the codification of working hour characteristics, we defined early morning shift (starts before 06:00 hours and is not categorized as a night shift), morning shift as a shift between 03:00 and 18:00, day shift as a shift between 08:00 and 18:00, evening shift that starts after 12:00 hours and is not categorized as a night shift and takes place shift between 18:00 and 23:00 for at least 3 hours, and night shift as a shift between 23:00 and 06:00 for at least 3 hours. The used shift definitions were modified from the health care sector^{12, 14} to the slightly different starting and ending times of the different shifts used in the retail sector. Even the classification of the timing of the shift was first not mutually exclusive; all working hours were categorized to single work shifts by giving highest priority in the categorization to the night shifts, the second highest to the evening shifts and the lowest priority to the day shifts. For working hour characteristics not evaluated in earlier studies, we applied the collective agreement of the commercial sector²⁸ and classified the length of shifts into short (<4 h), medium (4–9 h) and long (>9 h). Also based on the collective agreement²⁸, we defined a short interval between two shifts (quick return) as an interval shorter than 7 or 11 hours^{29, 30}. Lastly, long weekly working hours were defined as working longer than 37.5 hours, and very long weekly working

hours as working longer than 48 hours per week (see Table 1 for detailed definitions of all working hour characteristics). The working hour characteristics specific to the retail sector's collective agreement²⁸⁾ are indicated with an asterisk (*) in Table 1.

Statistical analyses

We calculated descriptive statistics using Stata MP 15.1 for Windows (StataCorp LLC, USA) including means, standard deviations (SD) and range (min-max) of annual working hour characteristics across employee groups: the full final sample, sexes, age groups, and part-time vs. full-time. We tested the differences in means accounting the large sample size and utilizing 99% confidence intervals. Due to the large number of different working hour characteristics evaluated ($n=35$), we chose not to present p-values in the tables as most of them were systematically non-significant (i.e., comparison between 2018 and 2020 in general or men and women) or significant (comparison between part-time vs. full-time). Furthermore, we created a heatmap for starting and ending times of work shifts. Based on the descriptive statistics (see Supplemental Table 1a–b), some working hour characteristics were very few or almost non-existent in the final sample, hence we excluded from analyses % of long (≥ 10 hours) shifts, % of very long (≥ 9) spells of work shifts, number of consecutive night shifts, % of long spells of consecutive night shifts, number of consecutive evening shifts, % of long spells of consecutive evening shifts, and % of low number of free days.

Results

The final sample included 2,176–2,338 full-time and 6,372–6,631 part-time employees in 2018–2020 (Table 2) of which 23% were men and the mean age was 33.5 (SD 12.9) among women and 32.3 (SD 11.6) among men. The mean age for part-time working women was 30.1 years (SD 12.2) and men 26.9 years (SD 9.7), whereas for full-time working women the mean age was 40.9 years (SD 11.1) and for men 37.5 years (SD 10.7). The means with standard deviations and ranges of working hour characteristics indicated similarity across years 2018–2020. The proportion of part-time work was 66% in 2018, 63% in 2019 and 60% in 2020 (Table 2). Hence for comparison of men and women and age groups we will present the further results for 2019 only.

The largest differences were seen in the distribution of morning shifts: full-time employees had 48–50% of morn-

ing shifts compared to 27–30% among part-time employees, whereas the amount of evening shifts was higher among part-time employees (43–46% compared to 26% in full-time employees). The night shift distribution was similar across part-time and full-time work.

Most working hour characteristics were less frequent (statistically significant, $p < 0.001$) among part-time employees than full-time employees in comparison for each year separately except number of free days in weekends, and % of single free days which were more frequent among part-time employees (Table 2). The comparison between men and women in part-time or full-time work (Table 3) did not show significant differences between sexes. Age groups had between differences among part-time employees indicating that those in their middle ages (36–45 years) worked longest work weeks and has least frequent Sundays off from work (Supplemental Table 1b). Instead, those youngest (≤ 25 years) worked evening shifts most often. Among full-time employees the age group differences were minor or non-existent (Supplemental Table 1a).

The heatmap of distribution of work shift starting and ending times with the duration of working hours (Fig. 1) indicates that the operating hours are emphasized to evenings. Short work shifts were relatively rare (see also e.g., Table 2).

Discussion

This relatively large prospective study with over 12,000 employees in the retail sector in Finland describes the working hour characteristics for part-time and full-time employees among both sexes, and across age groups. Earlier studies of the retail sector have addressed the irregular working hours, but studies of objective, pay-roll based working hours have been rare¹⁸⁾. Our study with codification of objective working hour characteristics shows clear differences between part-time and full-time employees, but not between sexes. This adds to the current knowledge since the number of men is low in the health care sector which constitutes mainly the earlier literature for objective working hour characteristics in irregular work^{12, 14)}.

Although this study was descriptive in nature, we would like to point out that evening shifts are emphasized in the retail sector (around 40–50% of all annual work shifts were evening shifts) compared to the health care sector (10–12%)^{12, 14)}, whereas many other working hour characteristics including quick returns (i.e., short shift intervals), length of daily or weekly working hours, and the amount of night work with known associations of health related out-

Table 1. Descriptions of working hour characteristics evaluated in this study

Working time dimension/variable	Description
Length of working hours	
Weekly working hours (h)	The average weekly (from Monday 00:00 to Sunday 24:00) working hours during the year. Calendar weeks without any work, that is on paid or non-paid leave, were excluded
% of long (>37.5 h) working weeks*	Proportion (%) of long working weeks: the proportion of calendar weeks of >37.5 weekly hours of all calendar weeks with work during the year
% of long (>48 h) working weeks	Proportion (%) of long working weeks: the proportion of calendar weeks of >48 weekly hours of all calendar weeks with work during the year
Shift length (h)	The average length of all shifts during the year in hours
% of long shifts	Proportion (%) of >9 h shifts/all shifts during the year
Number of long (>8 h/3 weeks) shifts*	The average number of >8h shifts/three weeks of all calendar weeks with work during the year
% of very long (≥10 hours) shifts	Proportion (%) of (≥10 h shifts/all shifts during the year
Length of night shifts (h)	The average length of all night shifts (subjects without night shifts excluded) during the year
Time of the day	
% of early morning shifts	Proportion (%) of early morning (M) shifts/all shifts during the year
% of morning shifts	Proportion (%) of morning (M) shifts/all shifts during the year
% of day shifts	Proportion (%) of day (D) shifts/all shifts during the year
% of evening shifts	Proportion (%) of evening (E) shifts/all shifts during the year
% of night shifts	Proportion (%) of night (N) shifts/all shifts during the year
Shift intensity	
Number of consecutive working days	The average number of consecutive daily work shifts (without free days) during the year (starting from and ending to a free day or other absence from work)
% of long (>5) spells of work shifts*	Proportion (%) of >5 consecutive daily work shifts (without free days/all spells of consecutive daily work shifts)
% of very long (≥9) spells of work shifts*	Proportion (%) of ≥9 consecutive daily work shifts (without free days/all spells of consecutive daily work shifts)
Number of consecutive work shifts with only one day off in between*	The average number of consecutive work shifts with only single free days in between during the year
Number of consecutive night shifts	The average number of consecutive night shifts during the year (subjects without night shifts excluded)

Table 1. Continued

Working time dimension/variable	Description
% of long spells of consecutive night shifts	Proportion (%) of ≥ 6 consecutive night shift spells during the year/all spells of consecutive daily night shifts
Number of consecutive evening shifts	The average number of consecutive evening shifts during the year, subjects without evening shifts excluded)
% of long spells of consecutive evening shifts	Proportion (%) of ≥ 4 consecutive evening shift spells during the year/all spells of consecutive daily evening shifts
Time between shifts (h)	The average time between work shifts (h) during the year (time between shift and free day or other absence excluded)
% of short shift intervals	Proportion (%) of shift intervals of < 11 h during the year/all shift intervals
% of very short shift intervals*	Proportion (%) of shift intervals of < 7 h during the year/all shift intervals
% of short recovery periods after the last night shift	Proportion (%) of < 28 h recovery periods after the last night shift during the year/all recovery periods after the last night shift
% of free days after the night shift	Proportion of < 48 h recovery periods after a night shift during the year/all recovery periods
% of single free days between two night shifts*	Proportion of single free days after a night shift during the year/all free days
% of short weekly recovery times	Proportion of work weeks with < 35 hours recovery period during the year/all work weeks
% weekly recovery time and free day	Proportion of work weeks with < 48 hours recovery period during the year/all work weeks
Number of free days within four weeks*	Average number of free days/four weeks during the year
% of low number of free days	Proportion of 4 weeks periods with < 6 free days during the year/all work weeks
Social aspects of working hours	
Number of free days in weekends	The average number of free days located in weekends (Friday-Sunday) during the year/all weekends
% of free weekends	Proportion of free weekends during the year/all weekends
Number of free days on Sundays*	The average number of free Sundays during the year/all Sundays
% of single free days	Proportion (%) of single free days/all free days

This table is modified based on an earlier study of the health care sector⁽⁴⁾. * Defined based on the collective agreement of the commercial sector.

Table 2. Working hour characteristics in 2018–2020 among part-time and full-time work

	2018						2019						2020					
	Full-time (n=2,176)		Part-time (n=6,372)		Full-time (n=2,309)		Part-time (n=6,562)		Full-time (n=2,338)		Part-time (n=6,631)		Full-time (n=2,338)		Part-time (n=6,631)			
	mean	sd	min-max	mean	sd	min-max	mean	sd	min-max	mean	sd	min-max	mean	sd	min-max	mean	sd	min-max
Weekly working hours (h)	36.5	3.2	0.3-43.9	27.5	6.6	0-41.4	36.1	4.2	6.0-44.6	27.2	6.8	0-44.7	36.1	4.5	0-43.5	27.2	7.2	0-47.9
% of long (>37.5 hours) working weeks	64	15	0-100	17	18	0-100	63	18	0-100	17	18	0-100	65	16	0-100	18	18	0-100
% of long (>48 hours) working weeks	3	4	0-50	1	2	0-50	3	4	0-30	1	2	0-22	3	4	0-50	1	2	0-33
Shift length (h)	7.9	0.3	0.3-9.5	7.0	0.7	2.0-8.8	7.9	0.4	4.0-9.4	7.1	0.7	2.0-9.3	7.9	0.3	4.2-9.1	7.2	0.7	2.0-9.1
% of short (<4 h) shifts	0	2	0-100	1	5	0-100	0	1	0-33	1	5	0-100	0	1	0-18	1	5	0-100
% of long (>9 h) shifts	4	7	0-80	2	5	0-69	4	7	0-78	2	6	0-79	4	7	0-63	2	5	0-62
Number of long (>8 h/3 weeks) shifts	12.1	3.8	0-17	7.5	5.3	0-17	12.0	4.2	0-17	7.4	5.4	0-17	12.3	4.0	0-17	7.4	5.3	0-17
Length of night shifts (h) ¹	8.4	1.5	3.0-22.0	8.0	1.5	3.9-28.5	8.4	1.7	3.0-29.0	7.9	1.2	3.0-25.8	8.3	1.4	6.0-26.0	8.0	1.4	4.5-29.0
% of early morning shifts	10	21	0-100	5	14	0-100	10	21	0-100	5	15	0-100	12	23	0-100	7	17	0-100
% of morning shifts	50	30	0-100	27	23	0-100	49	30	0-100	28	24	0-100	48	30	0-100	30	24	0-100
% of day shifts	11	12	0-76	19	15	0-100	11	12	0-100	19	16	0-100	10	13	0-100	17	15	0-100
% of evening shifts	26	23	0-100	46	24	0-100	26	23	0-100	45	24	0-100	26	24	0-100	43	24	0-100
% of night shifts	4	14	0-100	3	11	0-100	4	13	0-100	3	11	0-100	4	14	0-100	4	12	0-100
Number of consecutive working days	3.9	0.6	1-8	3.0	0.8	1-8	3.9	0.6	1-7.1	3.0	0.9	1-8.5	4.0	0.6	1-8	3.0	0.9	1-8.3
% of long (>5) spells of work shifts	15	12	0-100	8	10	0-100	15	12	0-100	8	10	0-100	16	12	0-100	8	10	0-100
Number of consecutive work shifts with only one day off in between	17.1	7.1	1-95	14.2	7.9	1-179	16.9	7.0	1-134	13.8	8.0	1-103	16.6	7.0	1-102	13.6	7.7	1-118
Time between shifts (h)	15.9	0.8	0-18.9	16.8	1.5	0-26	15.9	1.1	0-19.2	16.7	1.8	0-25.3	15.9	1.1	0-23.5	16.7	1.8	0-25.1
% of short (<11 hours) shift intervals	4	5	0-30	5	5	0-100	4	4	0-33	4	6	0-100	3	4	0-33	4	5	0-100
% of short recovery periods after the last night shift	37	39	0-100	25	35	0-100	33	14	0-100	21	31	0-100	36	38	0-100	19	30	0-100
% of free days after the night shift	55	39	0-100	46	39	0-100	51	39	0-100	42	37	0-100	52	38	0-100	35	36	0-100
% of single free days between two night shifts	20	40	0-100	13	33	0-100	19	39	0-100	14	35	0-100	21	41	0-100	17	38	0-100
% of short weekly recovery times	32	13	0-100	26	17	0-100	32	14	0-100	25	18	0-100	31	14	0-100	24	18	0-100
% weekly recovery time and free day	9	8	0-100	8	11	0-100	9	9	0-100	7	11	0-100	9	9	0-100	7	11	0-100
Number of free days within four weeks	11.9	3.0	1-14	9.1	4.3	1-14	11.3	3.3	0-13	8.9	4.3	0-13	11.6	3.1	0-13	9.0	4.3	0-13
Number of free days in weekends	29.8	9.0	7-52	32.6	11.4	5-52	29.5	9.5	8-52	32.5	11.6	5-52	29.2	9.6	8-52	32.4	11.5	1-52
% of free time in weekends	49	16	0-100	39	18	0-100	48	17	0-100	39	18	0-100	50	17	0-100	41	18	0-100
Number of free days on Sundays	40.4	9.1	8-52	39.8	8.9	6-52	39.9	9.6	11-52	39.7	9.2	7-52	39.7	9.8	12-52	39.6	9.4	2-52
% of single free days	40	21	1-100	48	27	2-100	39	22	1-100	48	28	2-100	36	20	1-100	44	28	1-100

¹ In 2018, the number of employees working night shifts was 685 among full-time and 1,136 among part-time employees. The respective numbers were 678 and 1,202 in 2019, and 714 and 1,436 in 2020.

Table 3. Working hour characteristics in 2019 among men and women working part-time or full-time

	2019											
	Full-time						Part-time					
	Women (n=1,726)			Men (n=536)			Women (n=5,215)			Men (n=1,405)		
	mean	sd	min-max	mean	sd	min-max	mean	sd	min-max	mean	sd	min-max
Weekly working hours (h)	36.6	3.4	6.0-44.6	37.1	2.4	20.8-43.5	27.3	6.6	4.0-41.4	26.8	7.2	0-44.7
% of long (>37.5 hours) working weeks	65	14	0-100	67	13	0-100	17	18	0-100	18	19	0-100
% of long (>48 hours) working weeks	3	4	0-28	4	5	0-30	1	2	0-20	1	2	0-22
Shift length (h)	7.9	0.3	4.0-15.0	8.0	0.2	6.7-9.0	7.1	0.7	2.0-9.3	7.1	0.8	2.0-8.9
% of short (<4 h) shifts	0	1	0-33	0	1	0-9	1	4	0-100	1	7	0-100
% of long (>9 h) shifts	4	8	0-100	4	6	0-39	2	5	0-69	2	6	0-79
Number of long (>8 h/3 weeks) shifts	12.6	3.7	0-17	12.7	3.5	0-17	7.6	5.4	0-17	7.0	5.4	0-17
Length of night shifts (h)	8.4	1.9	3.0-29.0	8.4	1.4	6.0-19.0	7.9	1.2	3.0-25.8	7.8	1.0	4.0-18.7
% of early morning shifts	10	21	0-100	10	23	0-100	5	15	0-100	5	16	0-100
% of morning shifts	50	30	0-100	51	31	0-100	28	23	0-100	28	26	0-100
% of day shifts	11	12	0-100	9	10	0-69	19	16	0-100	16	16	0-100
% of evening shifts	25	23	0-100	26	23	0-100	45	23	0-100	47	26	0-100
% of night shifts	4	13	0-100	4	12	0-100	3	11	0-100	4	14	0-100
Number of consecutive working days	3.9	0.6	1-6.6	4.0	0.6	2.0-7.1	3.0	0.8	1-7.2	3.0	0.9	1-8.5
% of long (>5) spells of work shifts	15	11	0-87	18	13	0-100	8	10	0-100	9	11	0-80
Number of consecutive work shifts with only one day off in between	17.1	7.1	1-134	17.6	6.3	3-51	13.9	7.7	1-103	13.9	8.9	1-85
Time between shifts (h)	15.9	1.2	0-22.5	16.0	0.4	14.6-17.8	16.7	1.7	0-25	16.7	2.1	0-25.3
% of short (<11 hours) shift intervals	4	5	0-33	4	4	0-27	5	5	0-100	4	6	0-100
% of short recovery periods after the last night shift	35	38	0-100	31	38	0-100	23	32	0-100	19	30	0-100
% of free days after the night shift	52	38	0-100	50	40	0-100	43	37	0-100	39	35	0-100
% of single free days between two night shifts	18	39	0-100	33	14	2-100	13	34	0-100	18	38	0-100
% of short weekly recovery times	32	13	0-100	33	14	2-100	25	17	0-100	24	18	0-100
% weekly recovery time and free day	9	8	0-100	9	10	0-100	7	10	0-100	7	10	0-100
Number of free days within four weeks	11.7	2.8	0-13	11.8	2.7	0-13	9.0	4.2	0-13	8.7	4.3	0-13
Number of free days in weekends	28.8	9.0	8-52	28.5	9.2	7-52	32.1	11.5	6-52	33.1	12.0	5-52
% of free time in weekends	49	16	0-100	48	17	0-100	40	17	0-100	37	20	0-100
Number of free days on Sundays	39.5	9.6	11-52	39.4	9.8	10-52	39.6	9.1	7-52	39.8	9.8	8-52
% of single free days	38	21	2-100	41	23	1-100	47	28	2-100	51	29	4-100

comes (i.e., sickness absence or injuries^{8, 10, 11}) seem to be moderate and similar as in health care sector^{12, 14}. Due to seasonal variations i.e., peaks in sales, but also slight differences across age groups, the codification of the working hour characteristics could provide means to paid attention to the working hour characteristics in order to avoid or prevent excessive loading. Furthermore, this study adds to the earlier literature of objective working hour characteristics that have mainly been based on studies of the health care sector^{12, 14}.

Earlier studies of the retail sector based on the survey data of shift work have indicated difficulties in work-life balance or in sleeping²⁰⁻²³. In this study, we lacked assessment of such outcomes and therefore focused on establishing the codification for working hour characteristics. However, given the moderate or low prevalence of night work and long working hours of this sample, our results are indicative that other aspects of working hour arrangements should be paid attention to planning and realizing regular working hours. For example, although the annual levels of night work were relatively low, the number of employees working nights increased from 2018 to 2020 especially among part-time employees and early morning shifts were prevalent both among part- and full-time employees. Since early morning shifts include waking up in very early hours, they play a role due to shortening the night sleep and requiring getting up at night. This might have an additional impact on already known associations of night work on health and wellbeing⁴⁻⁷, highlighting the need for assessing working hour characteristics of the retail sector.

The specific interest of this study was to compare part-time vs. full-time employees since part-time work is rare in the health care sector¹⁴. Our results indicate that part-time employees in general work less and have less working hour characteristics as could be expected in comparison to full-time workers. However, we did not detect differences between men and women that have seldom been investigated in the health care sector due to a low number of men^{12, 14}, and also age group differences were minor. A growing body of knowledge based on working hour characteristics in the health care sector have shown associations with increased risk of sickness absence^{9, 11} or injuries^{8, 31, 32}) based on the objective data. Such studies are currently lacking in the retail sector, although some estimations exist for the effects of extended opening hours on employment²¹ or mental health²². A specific need exists to address the working hour characteristics or patterns in shift work which might play a role in associations with health and wellbeing due to a large number of employees³ in the retail sector with a large pro-

portion of young employees²⁵) and women².

The strengths of this study include the utilization of objective, pay-roll based working hour data for three years on a relatively large (>12,000 employees) sample. Furthermore, we utilized the earlier developed and well documented codification of working hour characteristics^{12, 14}) as a base while further applying the collective agreement of the commercial sector to this study. This will provide for future studies possibilities to investigate working hours in detail to assess their effects on the risks of sickness absence, injuries, and work-life balance among other outcomes related to health and wellbeing. However, we had no survey data for employees hence preventing us evaluating self-reported factors such as a second job, health or work organization which may impact our results and should be addressed in further studies. The national perspective, i.e., this sample was based on the retail sector in Finland, will limit the generalizability before further studies with more regions in Finland or in other countries.

Conclusions

The applied and further developed codification for objective pay-roll based working hour data enables us to identify working hour characteristics of the retail sector. The working hour characteristics differed between part-time and full-time employees, but not between men and women and the differences were minor across age groups. The codification could be used in further studies in the retail sector in association with health and wellbeing.

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Authors Contributions

AR, TH and MiHä were involved in the study conception and design. AR was responsible for acquisition of data. AK and MaHi did the data curation and AR the statistical analyses. AR drafted the manuscript, and AR, TH, MaHi, AK and MiHä contributed to interpretation of data and the critical revision of the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

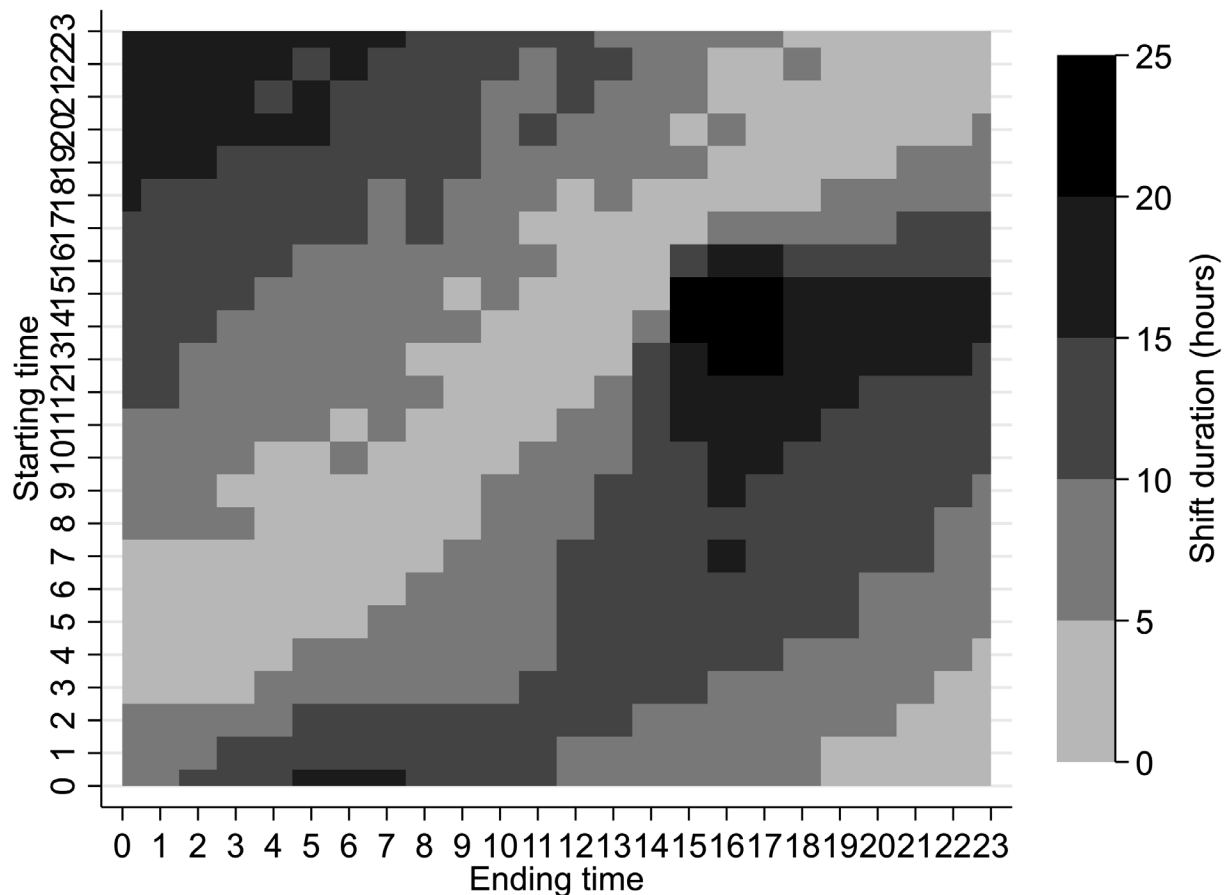


Fig. 1. Heatmap of distribution of work shift durations across shift starting and ending times.

Ethics Statements

The study protocol was designed and performed according to the principles of the Helsinki Declaration. The study was fully register-based and applied pseudonymized identification numbers. Research using such data does not need to undergo review by an ethics committee according to Finnish legislation.

Informed Consent Statement

Not applicable to administrative register data pseudonymized for research purposes.

Data available on request due to restrictions

These types of sensitive data can only be made available after legal review, for researchers who meet the criteria for access to these types of data. Requests can be sent to the first author.

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Supplemental Table 1a. Working hour characteristics in 2019 among full-time employees across age groups

	Full-time 2019														
	≤25 years (n=174)		26–35 years (n=691)		36–45 years (n=571)		46–55 years (n=583)		≥56 years (n=245)		min	max			
	mean	sd	min	max	mean	sd	min	max	mean	sd	min	max			
Weekly working hours (h)	36.1	3.8	7.0–40.3	36.4	3.5	6.5–42.9	36.8	3.4	6.0–43.1	37.0	2.5	8.4–44.6	36.8	3.0	10.4–43.5
% of long (>37.5 hours) working weeks	61	15	0–100	63	15	0–100	66	14	0–100	68	12	0–100	68	14	0–100
% of long (>48 hours) working weeks	4	5	0–30	4	4	0–22	4	4	0–30	3	4	0–30	3	4	0–26
Shift length (h)	7.9	0.2	7.0–8.4	8.0	0.3	6.2–15.0	7.9	0.3	4.0–9.1	8.0	0.2	5.4–9.4	7.9	0.2	5.9–9.0
% of short (<4 h) shifts	1	1	0–4	1	1	0–6	0	1	0–9	0	2	0–33	0	0	0–3
% of long (>9 h) shifts	5	7	0–42	5	8	0–100	4	7	0–73	4	7	0–78	3	5	0–40
Number of long (>8 h/3 weeks) shifts	11.3	4.5	0–16	12.1	4.1	0–17	12.9	3.6	0–17	13.2	2.9	0–17	12.8	3.2	0–16
Length of night shifts (h)	8.3	1.0	7.3–15.2	8.3	1.3	4.0–22.0	8.4	1.9	3.0–23.0	8.2	1.0	6.0–15.2	9.7	4.7	6.3–29.0
% of early morning shifts	11	22	0–96	10	20	0–99	11	23	0–98	11	24	0–100	9	21	0–100
% of morning shifts	43	27	0–98	52	29	0–100	54	29	0–100	48	31	0–100	49	32	0–100
% of day shifts	9	11	0–100	10	12	0–74	9	11	0–67	11	13	0–69	12	13	0–56
% of evening shifts	30	21	0–87	25	21	0–100	21	20	0–100	27	24	0–99	29	27	0–100
% of night shifts	6	16	0–100	4	12	0–100	4	14	0–100	3	13	0–100	2	9	0–100
Number of consecutive working days	4.0	0.7	1–6.3	4.0	0.6	1–7.1	4.0	0.6	1–7	4.0	0.5	1–6.6	3.9	0.5	1.3–6.0
% of long (>5) spells of work shifts	19	13	0–87	17	12	0–100	16	12	0–100	15	11	0–70	13	10	0–66
Number of consecutive work shifts with only one day off in between	17.9	7.4	1–58	17.0	6.7	1–71	17.6	8.1	1–134	17.1	6.0	1–70	16.7	6.1	4–79
Time between shifts (h)	15.9	1.3	0–17.2	15.9	1.3	0–18.8	15.9	1.1	0–22.5	15.9	0.8	0–17.8	15.9	0.4	14.5–18.4
% of short (<11 hours) shift intervals	5	5	0–33	4	4	0–21	4	5	0–25	4	5	0–26	3	4	0–20
% of short recovery periods after the last night shift	26	30	0–100	34	40	0–100	34	38	0–100	36	40	0–100	34	39	0–100
% of free days after the night shift	42	34	0–100	50	39	0–100	55	39	0–100	53	39	0–100	54	40	0–100
% of single free days between two night shifts	28	45	0–100	23	42	0–100	22	41	0–100	15	35	0–100	8	27	0–100
% of short weekly recovery times	31	14	0–100	31	14	0–100	33	13	0–100	33	13	0–67	34	14	2–71
% weekly recovery time and free day	9	8	0–50	9	10	0–100	9	8	0–100	8	6	0–39	9	7	0–40
Number of free days within four weeks	10.6	3.6	1–13	11.3	3.2	0–17	11.9	2.7	0–13	12.3	2.0	1–13	12.2	2.1	1–13
Number of free days in weekends	28.3	9.8	9–52	29.8	9.8	7–52	28.9	8.8	9–52	27.9	8.3	11–52	27.4	8.5	8–51
% of free time in weekends	41	15	0–88	49	17	0–100	50	16	0–100	49	15	12–100	48	15	12–100
Number of free days on Sundays	37.4	9.5	16–52	39.2	9.5	10–52	40.1	9.1	16–52	39.8	10.0	13–52	39.8	10.6	11–52
% of single free days	39	25	6–100	39	21	1–100	39	20	3–100	39	21	3–100	37	20	4–100

Supplemental Table 1b. Working hour characteristics in 2019 among part-time employees across age groups

	Part-time 2019														
	≤25 years (n=3,467)			26-35 years (n=1,572)			36-45 years (n=683)			46-55 years (n=575)			≥56 years (n=366)		
	mean	sd	min-max	mean	sd	min-max	mean	sd	min-max	mean	sd	min-max	mean	sd	min-max
Weekly working hours (h)	25.9	6.7	0-43.0	27.7	6.9	0-41.4	29.9	6.0	4.0-40.9	29.9	6.4	5.0-44.7	27.8	6.8	8.0-40.3
% of long (>37.5 hours) working weeks	14	16	0-100	20	19	0-100	23	20	0-100	22	19	0-100	17	18	0-79
% of long (>48 hours) working weeks	0	2	0-22	1	2	0-19	1	2	0-18	1	2	0-15	1	2	0-13
Shift length (h)	7.0	0.7	3.3-8.9	7.2	0.6	4.0-9.3	7.1	0.7	3.0-8.3	7.1	0.8	2.0-8.5	6.9	0.9	2.0-8.7
% of short (<4 h) shifts	1	3	0-93	1	3	0-100	1	4	0-100	1	9	0-100	2	10	0-100
% of long (>9 h) shifts	2	6	0-79	2	6	0-69	2	5	0-38	2	5	0-48	1	3	0-32
Number of long (>8 h/3 weeks) shifts	5.9	4.9	0-17	8.0	5.5	0-17	10.3	4.9	0-17	10.8	4.8	0-17	9.4	5.4	0-17
Length of night shifts (h)	7.8	1.0	4.0-18.7	7.9	1.2	4.8-24.0	8.0	1.9	3.0-25.8	8.1	1.6	6.2-20.7	7.7	0.7	6.0-9.0
% of early morning shifts	5	15	0-100	6	15	0-95	7	17	0-99	5	14	0-100	5	16	0-100
% of morning shifts	26	23	0-100	28	23	0-100	33	26	0-100	29	25	0-100	29	28	0-100
% of day shifts	19	15	0-100	17	15	0-100	19	16	0-100	21	19	0-100	22	21	0-100
% of evening shifts	47	23	0-100	44	24	0-100	39	23	0-100	42	25	0-100	44	28	0-100
% of night shifts	3	10	0-100	4	14	0-100	2	10	0-100	2	12	0-100	1	6	0-98
Number of consecutive working days	2.8	0.8	1-6.3	3.0	0.9	1-8.5	3.2	0.8	1-6.2	3.3	0.9	1-7.2	3.0	0.9	1-6.2
% of long (>5) spells of work shifts	7	9	0-100	9	11	0-100	10	10	0-89	11	11	0-66	8	11	0-74
Number of consecutive work shifts with only one day off in between	12.7	7.2	1-85	14.2	7.8	1-77	16.4	9.2	1-103	16.7	9.4	1-84	14.4	8.5	1-99
Time between shifts (h)	16.7	1.9	0-25.3	16.6	2.0	0-23.5	16.6	1.6	0-21.9	16.7	1.3	0-24.3	16.8	1.6	0-21.8
% of short (<11 hours) shift intervals	5	6	0-100	4	5	0-38	4	5	0-38	4	5	0-33	3	5	0-33
% of short recovery periods after the last night shift	19	30	0-100	23	32	0-100	30	36	0-100	21	30	0-100	21	37	0-100
% of free days after the night shift	39	36	0-100	44	36	0-100	52	39	0-100	43	36	0-100	47	44	0-100
% of single free days between two night shifts	15	36	0-100	17	37	0-100	11	32	0-100	10	31	0-100	3	18	0-100
% of short weekly recovery times	23	18	0-100	25	17	0-100	29	17	0-100	29	16	0-100	27	18	0-100
% weekly recovery time and free day	7	13	0-100	7	10	0-100	7	8	0-100	7	7	0-67	6	8	0-89
Number of free days within four weeks	7.6	4.2	0-13	9.4	4.2	0-13	10.8	3.6	0-13	11.4	3.2	1-13	11.1	3.3	0-13
Number of free days in weekends	35.2	11.4	6-52	31.2	11.6	7-52	28.3	10.6	5-52	26.3	10.0	8-52	29.6	11.1	9-52
% of free time in weekends	37	17	0-100	41	18	0-100	42	17	0-100	40	16	0-100	47	19	10-100
Number of free days on Sundays	41.1	8.7	8-52	38.7	9.5	8-52	37.7	9.7	7-52	36.7	9.5	10-52	40.2	9.5	11-52
% of single free days	53	30	3-100	44	26	2-100	43	25	3-100	43	23	3-100	42	24	4-100