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Long hours in paid and domestic work and subsequent sickness absence: does control over daily working hours matter?

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Objectives: To explore the associations of working hours (paid, domestic, commuting, and total) with sickness absence, and to examine whether these associations vary according to the level of employee control over daily working hours.

Methods: Prospective cohort study among 25 703 full-time public sector employees in 10 towns in Finland. A survey of working hours and control over working hours was carried out in 2000–01. The survey responses were linked with register data on the number of self-certified ($\leqslant$3 days) and medically certified ($>$3 days) sickness absences until the end of 2003. Poisson regression analyses with generalised estimating equations were used to take into account the fact that the employees were nested within work units. Adjustments were made for work and family characteristics and health behaviour. The mean follow-up period was 28.1 (SD 8.1) months.

Results: Long domestic and total working hours were associated with higher rates of medically certified sickness absences among both genders. In contrast, long paid working hours were associated with lower rates of subsequent self-certified sickness absences. Long commuting hours were related to increased rates of sickness absence of both types. Low control over daily working hours predicted medically certified sickness absences for both the women and men and self-certified absences for the men. In combinations, high control over working hours reduced the adverse associations of long domestic and total working hours with medically certified absences.

Conclusions: Employee control over daily working hours may protect health and help workers successfully combine a full-time job with the demands of domestic work.

Recent reviews[1–3] suggest a weak positive relation between long working hours and ill health. Long working hours may affect health by impairing the employee's possibilities for sufficient recovery, both mentally and physiologically. Long hours may also pose health risks if exposure to adverse work conditions is prolonged and if health related behaviour is affected.[1–3]

The health effects of working hours are not necessarily similar for men and women, yet the greater part of the evidence stems from all-male or predominantly male samples.[1–3] Some studies have found the effects of long working hours more detrimental to women's health.[4 5] The reasons for such gender differences are unclear, but the importance of exploring workloads in both paid and domestic work has been acknowledged.[1–3 6] Women are generally exposed to longer working hours at home than men,[7] but whether there are gender differences in vulnerability to the possible adverse effects of these hours[8] remains an open question. To date, the evidence on the health effects of domestic working hours for women and men is scarce and inconclusive.[9–12] In between paid and domestic working hours, long commuting hours may also carry health risks.[13 14]

The possibilities of influencing one's working hours may enable workers to adjust their working hours to prevailing resources at work and also to the demands of their private lives. Therefore perceived control over working times, reflecting the practical possibilities, may reduce health problems rising from work stress and also from stress due to conflicting demands from paid and domestic work. Indeed, high employee worktime control has been shown to predict good subjective health and less sickness absence.[15 16] Such control has also been found to be associated with reduced stress related absenteeism.[17]

The earlier finding that particularly women seem to profit from worktime control has been assumed to stem from gender differences in non-work demands.[15 16] However, this hypothesis has not been directly addressed. As non-work demands are reflected in the number of domestic working hours, the employees with the most hours of domestic work could benefit the most from high control over hours in paid work. On the other hand, as suggested in earlier cross-sectional studies, employees who work the longest hours in paid work could benefit from high worktime control more than those with fewer hours.[18 19] Obviously, worktime control could also help in optimising commuting hours.

In this prospective study of a large cohort of public sector employees with a wide variety of occupations, we explored the associations of self-reported paid and domestic working hours, commuting hours, and control over daily working hours with registered sickness absence. Our aim was to determine whether the associations between paid, domestic, commuting, and total working hours and subsequent sickness absence vary by the level of control over daily working hours. To detect gender differences, the analyses were performed separately for women and men.

METHODS

Design and participants

Data were drawn from the ongoing 10-Town Study exploring employee health in 10 towns in Finland. In 2000 and 2001, we mailed a questionnaire assessing working hours and control over working hours to all of the 48 103 full-time

Table 1 Descriptive statistics: women (n = 19 899)

	n (%)	Paid hours per week Mean (SE)	Domestic hours per week Mean (SE)	Commuting hours per week Mean (SE)	Total hours* per week Mean (SE)	Control over working hours Mean (SE)
Age group (years)		p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
⩽39	5630 (28)	38.7 (0.1)	17.0 (0.1)	4.0 (0.0)	59.6 (0.2)	2.22 (0.01)
40–49	7184 (36)	39.1 (0.1)	19.1 (0.1)	4.1 (0.0)	62.1 (0.1)	2.26 (0.01)
⩾50	7085 (36)	39.1 (0.1)	18.8 (0.1)	4.3 (0.0)	61.9 (0.1)	2.10 (0.01)
Marital status		p=0.463	p<0.001	p=0.513	p<0.001	p=0.895
Married or cohabiting	14616 (74)	39.0 (0.0)	19.5 (0.1)	4.1 (0.0)	62.4 (0.1)	2.19 (0.01)
Single, separated, widowed	5072 (26)	39.1 (0.1)	15.1 (0.1)	4.2 (0.0)	58.2 (0.2)	2.19 (0.02)
Family		p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
No children	9089 (46)	39.0 (0.1)	15.5 (0.1)	4.3 (0.0)	58.5 (0.1)	2.18 (0.01)
Child(ren) 0–6 years	2532 (13)	38.7 (0.1)	20.7 (0.2)	4.3 (0.1)	63.4 (0.2)	2.11 (0.02)
Child(ren) 7–18 years	6073 (31)	39.3 (0.1)	20.1 (0.1)	3.9 (0.0)	63.1 (0.2)	2.24 (0.01)
Children 0–18 years	2027 (10)	39.0 (0.1)	23.1 (0.2)	4.0 (0.1)	66.0 (0.3)	2.19 (0.03)
Occupational status		p<0.001	p<0.001	p=0.006	p<0.001	p<0.001
Upper non-manual	6849 (35)	38.7 (0.1)	17.6 (0.1)	4.1 (0.0)	60.4 (0.1)	2.39 (0.01)
Lower non-manual	10095 (51)	39.3 (0.1)	18.8 (0.1)	4.2 (0.0)	61.8 (0.1)	2.15 (0.01)
Manual	2703 (14)	38.9 (0.1)	19.1 (0.2)	4.2 (0.1)	62.2 (0.2)	1.82 (0.02)
Permanent employment		p=0.009	p<0.001	p=0.913	p<0.001	p<0.001
Yes	16734 (85)	39.1 (0.0)	18.8 (0.1)	4.1 (0.0)	61.8 (0.1)	2.17 (0.01)
No	3067 (15)	38.8 (0.1)	16.2 (0.2)	4.1 (0.0)	58.9 (0.2)	2.28 (0.02)
Type of schedule		p=0.006	p<0.001	p<0.001	p<0.001	p<0.001
Standard hours	15336 (78)	38.9 (0.0)	18.1 (0.1)	4.0 (0.0)	60.9 (0.1)	2.28 (0.01)
Shifts, no nights	2781 (14)	39.3 (0.1)	19.2 (0.2)	4.4 (0.1)	62.8 (0.2)	2.02 (0.02)
Shifts, also nights	1447 (7)	39.2 (0.2)	19.3 (0.3)	4.6 (0.1)	62.9 (0.3)	1.63 (0.03)
Smoking		p=0.018	p<0.001	p=0.316	p=0.032	p=0.281
No	15936 (82)	38.9 (0.0)	18.5 (0.1)	4.2 (0.0)	61.4 (0.1)	2.19 (0.01)
Yes	3424 (18)	39.2 (0.1)	17.8 (0.2)	4.1 (0.0)	60.9 (0.2)	2.17 (0.02)
High alcohol intake		p=0.630	p<0.001	p=0.269	p<0.001	p<0.001
No	18411 (93)	39.0 (0.0)	18.5 (0.1)	4.2 (0.0)	61.5 (0.1)	2.18 (0.01)
Yes	1395 (7)	38.9 (0.2)	16.9 (0.3)	4.1 (0.1)	59.7 (0.3)	2.32 (0.03)
Overweight		p<0.001	p=0.001	p=0.008	p<0.001	p=0.239
No	14645 (75)	38.9 (0.0)	18.3 (0.1)	4.1 (0.0)	61.1 (0.1)	2.19 (0.01)
Yes	4810 (25)	39.5 (0.1)	18.8 (0.1)	4.2 (0.0)	62.2 (0.2)	2.17 (0.02)
Sedentary lifestyle		p=0.003	p=0.883	p=0.001	p=0.470	p=0.562
No	16868 (86)	39.0 (0.0)	18.4 (0.1)	4.2 (0.0)	61.3 (0.1)	2.19 (0.01)
Yes	2827 (14)	39.3 (0.1)	18.4 (0.2)	4.1 (0.1)	61.5 (0.2)	2.20 (0.02)

*Sum of paid working hours, domestic working hours, and hours commuting.

employees who had a contract of employment lasting at least until the end of the survey year. Of the 32 299 (67%) responders we included in this study the 25 703 responders in 2543 identifiable work units who provided information on their control over working hours, had more than 6 months of follow-up and gave their consent for their questionnaire responses to be linked to their records on sickness absence (87% of the respondents who fulfilled other criteria gave consent). Health problems in the years following the survey, as indicated by sickness absence, were monitored until the end of 2003. The mean follow-up time was 28.1 (SD 8.1) months.

The sample did not substantially differ from the eligible population in terms of age, occupational status, and sickness absence. In the sample, the mean age was 45 years, the proportion of upper non-manual workers 36%, lower non-manual workers 46%, and manual workers 18%; rates for self-certified and medically certified sickness absence per person-year were 1.37 and 0.78, respectively. In the eligible population, the mean age was 45 years, 34% were upper non-manual workers, 44% were lower non-manual workers, and 22% were manual workers; corresponding absence rates were 1.46 and 0.86. The proportions of women (77%) and permanent employees (85%) were somewhat higher in the sample than in the eligible population (73% women, 81% permanent). The Ethics Committee of the Finnish Institute of Occupational Health approved the study.

Working hours

Paid working hours were summed from the respondents' reports of their (i) official working hours per day and (ii) mean hours of paid or unpaid overtime and their mean hours in another job per day.[20] The daily working hours were multiplied by 5 for the weekly hours in paid work (women: mean 39.0, SD 5.7; men: mean 41.0, SD 7.7) and then further divided into the following three categories: up to 40, over 40 to 50, and over 50 hours per week. These categories were based on recent reviews[1 3] suggesting health risks for working over 50 hours per week and calling for research on moderately long hours (over 40 hours per week).

Reports of daily two-way *commuting hours* were multiplied by 5, for the weekly hours spent in commuting between work and home (women: mean 4.1, SD 2.9; men: mean 3.9, SD 2.8). Corresponding to one-way travelling times of up to 15 minutes, over 15 to 45 minutes, and over 45 minutes, the weekly commuting hours were grouped into the categories of up to 2.5 hours, over 2.5 to 7.5 hours, and over 7.5 hours per week, the latter cut-off point set as in a previous EU survey.[14]

The respondents rated their mean daily *domestic working hours* (caring for children and other near ones, cleaning, washing laundry, doing home maintenance, etc) separately for working days and days off. The former ratings were multiplied by 5 and the latter by 2, for the weekly hours in domestic work (women: mean 18.4, SD 10.1; men: mean 12.1, SD 9.8). These figures were then further divided into the three categories of up to 10, over 10 to 25, and over 25 hours per week. As no established thresholds of potentially harmful domestic hours exist, these categories were chosen to allow for the possibility of exploring the effects of clearly long and short domestic hours and to enable comparisons between the women and men.

The *total working hours* per week included hours in paid and domestic work added to hours spent in commuting between home and work (women: mean 61.3, SD 11.7; men: mean 56.9, SD 12.6). The components of total working hours were not inter-correlated (between paid and domestic hours, Pearson's $r = -0.02$; between paid and commuting hours, $r = -0.00$; and between domestic and commuting hours, $r = 0.06$), enabling them to be studied separately. To explore the effects of the differential exposures and to enable comparisons by gender, we divided the total working hours into the three categories of up to 50, over 50 to 75, and over 75 hours per week.

Control over daily working hours

Using a 1–5 scale (very little–very much), the responders rated their ability to influence the length of their workday and the starting and ending times of their workday, measuring control over daily working hours. The items focused on the employees' perception of the extent of personal control over daily working hours, a correlate of the practical possibilities of exerting such control. The mean of the two items was used (2.21, SD 1.2) and further divided into quartiles and median splits. A more detailed description of the worktime control instrument has been published elsewhere.[17]

Sickness absence

Data on sickness absence were derived from the employers' routinely kept registers. The health prospects of the respondents were monitored in the years following the surveys, until the end of 2003. Absences in the survey year were not noted. All sick leaves are reliably recorded, including the dates when each period started and ended. Medical certificates are required for sick leaves longer than 3 days. In cases of shorter leaves, the employees inform their supervisor on the morning of the first day of absence and later fill out their own certificate explaining their absence. The employees are paid full salary during sick leaves.

Table 2 Descriptive statistics: men (n = 5804)

	n (%)	Paid hours per week Mean (SE)	Domestic hours per week Mean (SE)	Commuting hours per week Mean (SE)	Total hours* per week Mean (SE)	Control over working hours Mean (SE)
Age group (years)		p<0.001	p=0.004	p=0.561	p<0.001	p=0.769
⩽39	1581 (27)	41.0 (0.2)	12.4 (0.3)	3.9 (0.1)	57.1 (0.3)	2.30 (0.03)
40–49	1916 (33)	41.6 (0.2)	12.6 (0.2)	4.0 (0.1)	58.0 (0.3)	2.27 (0.03)
⩾50	2307 (40)	40.5 (0.2)	11.7 (0.2)	3.9 (0.1)	55.9 (0.3)	2.29 (0.03)
Marital status		p=0.227	p<0.001	p=0.043	p<0.001	p=0.073
Married or cohabiting	4655 (81)	40.9 (0.1)	12.7 (0.1)	4.0 (0.0)	57.5 (0.2)	2.30 (0.02)
Single, separated, widowed	1094 (19)	41.2 (0.2)	9.76 (0.3)	4.0 (0.1)	54.4 (0.4)	2.22 (0.04)
Family		p=0.003	p<0.001	p=0.005	p<0.001	p=0.259
No children	2803 (49)	40.9 (0.1)	10.1 (0.2)	3.8 (0.1)	54.6 (0.2)	2.30 (0.02)
Child(ren) 0–6 years	889 (15)	40.3 (0.3)	15.3 (0.3)	4.1 (0.1)	59.7 (0.4)	2.20 (0.04)
Child(ren) 7–18 years	1463 (25)	41.4 (0.2)	12.6 (0.3)	3.9 (0.1)	57.8 (0.3)	2.30 (0.03)
Children 0–18 years	611 (11)	41.5 (0.3)	16.0 (0.4)	4.2 (0.1)	61.5 (0.5)	2.28 (0.05)
Occupational status		p<0.001	p<0.001	p=0.129	p<0.001	p<0.001
Upper non-manual	2208 (39)	40.4 (0.2)	11.7 (0.2)	4.0 (0.1)	56.0 (0.3)	2.81 (0.02)
Lower non-manual	1479 (26)	40.5 (0.2)	12.3 (0.3)	3.8 (0.1)	56.5 (0.3)	2.43 (0.03)
Manual	1975 (35)	42.0 (0.2)	12.8 (0.2)	3.9 (0.1)	58.4 (0.3)	1.59 (0.03)
Permanent employment		p=0.053	p=0.015	p=0.721	p=0.003	p<0.001
Yes	5109 (88)	41.0 (0.1)	12.3 (0.1)	3.9 (0.0)	57.1 (0.2)	2.24 (0.02)
No	662 (12)	40.4 (0.3)	11.3 (0.4)	3.9 (0.1)	55.5 (0.5)	2.61 (0.05)
Type of schedule		p<0.001	p=0.650	p<0.001	p<0.001	p<0.001
Standard hours	4447 (78)	40.1 (0.1)	12.2 (0.1)	3.8 (0.0)	56.0 (0.2)	2.39 (0.02)
Shifts, no nights	587 (10)	42.2 (0.3)	12.5 (0.4)	4.1 (0.1)	58.8 (0.5)	2.24 (0.05)
Shifts, also nights	687 (12)	45.1 (0.3)	12.5 (0.4)	4.5 (0.1)	61.7 (0.5)	1.60 (0.05)
Smoking		p=0.015	p=0.579	p=0.113	p=0.107	p<0.001
No	4238 (76)	40.8 (0.1)	12.1 (0.2)	3.9 (0.0)	56.8 (0.2)	2.33 (0.02)
Yes	1361 (24)	41.4 (0.2)	12.3 (0.3)	3.8 80.1)	57.4 (0.4)	2.15 (0.03)
High alcohol intake		p=0.296	p=0.004	p=0.067	p=0.019	p=0.141
No	4512 (78)	40.9 (0.1)	12.4 (0.1)	3.9 (0.0)	57.1 (0.2)	2.27 (0.02)
Yes	1264 (22)	41.2 (0.2)	11.5 (0.3)	3.8 (0.1)	56.1 (0.4)	2.33 (0.04)
Overweight		p=0.007	p=0.046	p=0.750	p=0.753	p=0.025
No	3717 (65)	40.8 (0.1)	12.4 (0.2)	3.9 (0.0)	56.9 (0.2)	2.31 (0.02)
Yes	2010 (35)	41.4 (0.2)	11.8 (0.2)	3.9 (0.1)	57.0 (0.3)	2.23 (0.03)
Sedentary lifestyle		p=0.579	p=0.659	p=0.146	p=0.334	p=0.046
No	4771 (83)	40.9 (0.1)	12.2 (0.1)	3.9 (0.0)	57.0 (0.2)	2.30 (0.02)
Yes	971 (17)	41.1 (0.3)	12.0 (0.3)	3.8 (0.1)	56.5 (0.4)	2.21 (0.04)

*Sum of paid working hours, domestic working hours, and hours commuting.

Table 3 Adjusted* rate ratios and their 95% confidence intervals for sickness absences by the level of paid, domestic, and total† working hours and by the level of control over daily working hours (Poisson regression GEE models)

			Self-certified (⩽3 days) sickness absences		Medically certified (>3 days) sickness absences	
		n (%)	Age adjusted	Fully adjusted*	Age adjusted	Fully adjusted*
Women						
Paid hours/week	⩽40	14739 (77)	1.00	1.00	1.00	1.00
	⩽50	3822 (20)	0.89 (0.86–0.93)	0.92 (0.88–0.96)	0.90 (0.86–0.95)	0.97 (0.93–1.02)
	>50	635 (3)	0.77 (0.69–0.86)	0.78 (0.70–0.88)	0.91 (0.81–1.02)	0.94 (0.83–1.05)
Domestic hours/week	⩽10	3737 (19)	1.00	1.00	1.00	1.00
	⩽25	12215 (63)	1.00 (0.96–1.04)	1.03 (0.98–1.07)	1.03 (0.97–1.08)	1.06 (1.00–1.12)
	>25	3456 (18)	1.00 (0.95–1.0)	1.02 (0.97–1.08)	1.14 (1.07–1.22)	1.15 (1.08–1.24)
Commuting hours/week	⩽2.5	8017 (42)	1.00	1.00	1.00	1.00
	⩽7.5	9381 (49)	1.08 (1.05–1.11)	1.09 (1.05–1.12)	1.03 (0.99–1.07)	1.03 (0.99–1.07)
	>7.5	1715 (9)	1.19 (1.13–1.26)	1.21 (1.14–1.28)	1.19 (1.11–1.27)	1.18 (1.10–1.26)
Total hours/week†	⩽50	2436 (13)	1.00	1.00	1.00	1.00
	⩽75	13840 (76)	1.05 (1.00–1.10)	1.05 (1.00–1.10)	1.08 (1.02–1.15)	1.10 (1.03–1.17)
	>75	1970 (11)	1.07 (1.00–1.14)	1.07 (1.00–1.15)	1.24 (1.14–1.34)	1.26 (1.17–1.37)
Control over working hours‡	4 high	3536 (18)	1.00	1.00	1.00	1.00
	3	4744 (24)	1.08 (1.03–1.13)	1.07 (1.02–1.13)	1.14 (1.07–1.22)	1.13 (1.07–1.21)
	2	5421 (27)	1.12 (1.07–1.18)	1.11 (1.06–1.16)	1.30 (1.23–1.38)	1.24 (1.17–1.31)
	1 low	6198 (31)	1.14 (1.09–1.19)	1.11 (1.06–1.16)	1.47 (1.38–1.56)	1.38 (1.29–1.46)
Men						
Paid hours/week	⩽40	3439 (61)	1.00	1.00	1.00	1.00
	⩽50	1765 (31)	0.76 (0.70–0.82)	0.79 (0.73–0.85)	0.83 (0.74–0.93)	0.90 (0.82–1.00)
	>50	431 (8)	0.82 (0.72–0.93)	0.83 (0.73–0.95)	1.04 (0.90–1.19)	0.96 (0.84–1.09)
Domestic hours/week	⩽10	2972 (54)	1.00	1.00	1.00	1.00
	⩽25	2118 (38)	1.02 (0.95–1.10)	1.01 (0.94–1.09)	1.15 (1.06–1.26)	1.14 (1.05–1.25)
	>25	447 (8)	1.10 (0.99–1.23)	1.09 (0.97–1.22)	1.32 (1.14–1.52)	1.27 (1.11–1.46)
Commuting hours/week	⩽2.5	2583 (46)	1.00	1.00	1.00	1.00
	⩽7.5	2669 (47)	1.08 (1.01–1.16)	1.10 (1.03–1.19)	1.00 (0.92–1.09)	1.04 (0.97–1.12)
	>7.5	402 (7)	1.14 (0.99–1.31)	1.21 (1.04–1.39)	1.14 (0.96–1.34)	1.16 (1.00–1.35)
Total hours/week†	⩽50	1690 (32)	1.00	1.00	1.00	1.00
	⩽75	3194 (60)	0.99 (0.92–1.07)	0.99 (0.91–1.07)	1.14 (1.03–1.26)	1.13 (1.03–1.24)
	>75	447 (8)	1.06 (0.94–1.19)	1.04 (0.92–1.16)	1.35 (1.14–1.60)	1.23 (1.05–1.45)
Control over working hours‡	4 high	1435 (25)	1.00	1.00	1.00	1.00
	3	1123 (19)	1.24 (1.11–1.38)	1.22 (1.09–1.36)	1.20 (1.05–1.38)	1.16 (1.01–1.33)
	2	1096 (19)	1.21 (1.08–1.35)	1.17 (1.04–1.31)	1.50 (1.31–1.71)	1.26 (1.10–1.45)
	1 low	2150 (37)	1.41 (1.28–1.57)	1.28 (1.14–1.43)	1.91 (1.71–2.14)	1.38 (1.22–1.57)

*Adjusted for age, occupational status, type of work contract, type of work schedule, marital status, dependent children, consumption of alcohol, smoking, overweight, and sedentary lifestyle.
†Paid and domestic working hours and hours commuting.
‡Quartiles.

Maternity leaves and absences to care for a sick child are not recorded as sick leave. The regulations permit up to 3 paid days off work to care for acutely ill children under 10 years of age, and the annual number of such 3-day periods is not limited. Thus the participants had no reason to falsely report being ill when caring for a sick child.

Background variables

Information on age, gender, work unit, type of work contract (permanent/fixed-term), and occupational status was obtained from the employers' records. The five-digit coded[21] occupational titles were categorised into upper and lower non-manual and manual statuses. The survey responses on work schedule were classified into standard hours (weekdays, daytime only), evening and/or weekend shifts but no night shifts, and also night shifts. Of the family characteristics, we surveyed marital status (married/cohabiting versus other) and family type (no children, only preschool child(ren) 0–6 years of age, only schoolchild(ren) 7–18 years of age, or children in both age groups). The behavioural and biological health risks measured were smoking status (current smoker or non-smoker), high alcohol consumption (>200 g alcohol per week), sedentary lifestyle (<30 minutes of fast walking per week), and overweight (body mass index >27 kg/m^2).

Statistical analysis

We used analyses of variance to study the associations of paid, domestic, commuting, and total working hours and control over daily working hours with the background variables. After checking the employers' sickness absence records and combining the overlapping and consecutive periods, we calculated the individual numbers of sick leave periods and the individual person-years representing ''days at risk for sickness absence'' by excluding the days absent for reasons other than sickness. Short sickness absences lasting up to 3 days, for which self-certificates are sufficient, were differentiated from the longer ones that required a doctor's certificate.

The associations of the four types of working hours and of control over daily working hours with the subsequent rates of sick leaves per person-years were studied by Poisson regression models and expressed as rate ratios (RR) and their 95% confidence intervals (95% CI). To take into account

the fact that individual employees were nested within work units, we applied Poisson regression analyses with generalised estimating equations (GEE). Adjustments were made for age only, then for age, work related variables (occupational status, type of work contract, and schedule), family related variables (marital status, dependent children), and health risk behaviour (smoking, alcohol consumption, overweight, and sedentary lifestyle).

To study the joint associations of the various working hours and control over daily working times with subsequent sickness absence, we formulated combination variables by cross-tabulating the assessments of working hours (three categories) and the levels of control over working hours (median splits). The effects of the resulting six combinations of the levels of the hours with high or low control over working hours on subsequent sickness absence were studied by Poisson regression (GEE) models using the hypothetically least adverse condition (lowest number of hours with high control over working hours) as the reference category.[17] The significance of these joint effects was studied using appropriate cross-product terms (hours × control over working hours). Adjustments were made according to the aforementioned strategy.

Finally, to explore how the joint associations of working hours and worktime control with sickness absence relate to shift work among the women and men combined, the analyses were replicated in subgroups differentiating those working standard hours from those who participate in shift work.

RESULTS

Tables 1 and 2 present the descriptive statistics of the study sample. The associations between family characteristics and the levels of paid working hours were weak, but the women and men with a spouse or preschool children at home worked the longest domestic and total hours. Male manual employees worked longer paid hours than did white collar males, and male shift workers worked longer paid hours than the men with standard hours. Shift workers reported longer commuting hours than did those with standard hours. Control over daily working hours was higher among non-manual than manual employees as well as among those working standard hours when compared with those in shift work. The men with fixed-term work contracts had higher control over working hours than the men with permanent contracts.

The relationships of the working hours and control over working hours with subsequent sickness absences are shown in table 3. After adjustment for work and family characteristics and health behaviour, long paid working hours were related to lower rates of subsequent self-certified sickness absences among both the women and men. Long domestic and total working hours were associated with higher rates of medically certified sickness absences among both the women and the men. Corresponding associations were not found for self-certified absences. Long commuting hours were related to increased rates for both medically and self-certified sickness absences.

The women and men with low control over daily working hours took 1.1–1.3 times more self-certified absences than those with high worktime control. The effect on medically certified sickness absences was slightly greater in that the rates of subsequent medically certified sickness absences were 1.4-fold higher for the women and men with low control over their daily working hours than for those with high worktime control.

Table 4 shows the joint associations of the paid, commuting, domestic, and total hours and the level of control over working hours with the subsequent rates of sickness absence. High control over working hours reduced medically certified absences only for the women working up to 50 *paid* hours per week, but not for those with longer paid hours. Among the men, high worktime control and fewer medically certified absences were related irrespective of the number of paid hours. The negative association between paid hours and self-certified sickness absence was not dependent on the level of worktime control for either gender.

The effects of low control over working hours and long *domestic* hours on medically certified sickness absence were additive. Compared with the women with the shortest domestic hours and high worktime control, the women working the longest hours in domestic work had medically certified sickness absences 1.1-fold more often if their control over working times was high, but the rate was 1.4-fold higher if it was low. The corresponding figures for the men were 1.4 and 1.6, respectively. The women's self-certified absences were only weakly associated with long domestic hours combined with low worktime control, whereas the few men with the longest domestic hours and low worktime control took 1.3 times more self-certified absences than those with the shortest domestic hours and high worktime control.

Long *commuting* hours were associated with increased rates of medically certified sickness absences, mainly among the women and men with low worktime control. Also the association of long commuting hours with increased self-certified absences was more pronounced in combination with low worktime control.

Similarly, long *total* working hours and low worktime control were additively associated with medically certified sickness absence. Compared with the women with the shortest total hours and high worktime control, the women and men exposed to over 75 total hours per week had an absence rate that was 1.2-fold higher in combination with high control of working hours and 1.5-fold higher in combination with low worktime control. For the men, the corresponding figures were 1.3 and 1.6, respectively. Self-certified absences were associated with long total working hours and low worktime control, among the women synergistically (p for interaction 0.022 for the women, 0.264 for the men) in that long total hours predicted increased rates of self-certified absence in combination with low worktime control but not when the latter was high.

Elsewhere, we found no significant interactions between the various working hours and control over daily working hours ($p > 0.1$), nor interactions with gender ($p > 0.2$).

Table 5 presents the joint associations of the working hours and control over working hours with medically certified sickness absences in subgroups by work schedule without gender stratification. The results of the shift workers paralleled those observed for the employees working standard hours, with the exception that shift workers with long domestic working hours had less advantage of high control over working hours.

DISCUSSION

In this cohort of over 25 000 full-time public sector employees, low control over daily working hours as well as long domestic working hours (>25 per week), long commuting hours (>7.5 per week), and long total working hours (>75 per week) were all associated with increased rates of medically certified sickness absences for both the women and the men. Long commuting hours were related also to increased self-certified absences. In contrast, long hours in paid work (>50 per week) were associated with reduced rates of self-certified absences. Importantly, the associations between long domestic, commuting, and total working hours and medically certified absences were attenuated in combination with high control over working hours. This finding

Table 4 Adjusted* rate ratios and their 95% confidence intervals for sickness absences by the level of paid, domestic, and total working hours combined with the level of control over daily working hours (repeated measures Poisson regression GEE analyses according to work units)

		Self-certified (⩽3 days) sickness absences Control over working hours†		Medically certified (>3 days) sickness absences Control over working hours†	
Women		**High n=8280 (42%)**	**Low n=11 619 (58%)**	**High n=8280 (42%)**	**Low n=11 619 (58%)**
Paid hours/week	⩽40	1.00	1.06 (1.02–1.10)	1.00	1.21 (1.16–1.27)
	⩽50	0.92 (0.87–0.98)	0.98 (0.93–1.04)	0.97 (0.90–1.05)	1.22 (1.14–1.31)
	>50	0.80 (0.67–0.96)	0.81 (0.70–0.94)	1.08 (0.91–1.28)	1.05 (0.91–1.21)
Domestic hours/week	⩽10	1.00	1.05 (0.98–1.13)	1.00	1.15 (1.05–1.27)
	⩽25	1.03 (0.97–1.10)	1.07 (1.01–1.14)	1.02 (0.94–1.11)	1.24 (1.15–1.35)
	>25	0.96 (0.89–1.04)	1.11 (1.03–1.19)	1.11 (1.00–1.23)	1.35 (1.22–1.48)
Commuting hours/week	⩽2.5	1.00	1.04 (0.99–1.09)	1.00	1.18 (1.11–1.25)
	⩽7.5	1.06 (1.01–1.11)	1.15 (1.10–1.20)	0.99 (0.93–1.05)	1.24 (1.16–1.31)
	>7.5	1.19 (1.08–1.30)	1.27 (1.18–1.36)	1.10 (0.99–1.24)	1.42 (1.31–1.55)
Total hours/week‡	⩽50	1.00	1.04 (0.95–1.13)	1.00	1.13 (1.01–1.27)
	⩽75	1.05 (0.97–1.12)	1.10 (1.02–1.18)	1.04 (0.95–1.14)	1.29 (1.18–1.42)
	>75	0.97 (0.87–1.07)	1.19 (1.08–1.30)	1.22 (1.07–1.39)	1.46 (1.31–1.64)
Men		**High n=2558 (44%)**	**Low n=3246 (56%)**	**High n=2558 (44%)**	**Low n=3246 (56%)**
Paid hours/week	⩽40	1.00	1.08 (0.98–1.20)	1.00	1.24 (1.11–1.38)
	⩽50	0.77 (0.69–0.87)	0.87 (0.78–0.98)	0.93 (0.79–1.08)	1.13 (0.98–1.30)
	>50	0.77 (0.61–0.96)	0.96 (0.82–1.11)	0.99 (0.81–1.21)	1.19 (1.00–1.43)
Domestic hours/week	⩽10	1.00	1.13 (1.01–1.26)	1.00	1.32 (1.17–1.50)
	⩽25	1.05 (0.93–1.17)	1.11 (0.99–1.25)	1.22 (1.06–1.41)	1.46 (1.29–1.67)
	>25	1.10 (0.86–1.18)	1.30 (1.09–1.54)	1.43 (1.14–1.79)	1.61 (1.33–1.94)
Commuting hours/week	⩽2.5	1.00	1.17 (1.04–1.30)	1.00	1.22 (1.08–1.38)
	⩽7.5	1.17 (1.04–1.31)	1.25 (1.11–1.40)	1.01 (0.87–1.16)	1.30 (1.15–1.48)
	>7.5	1.16 (0.93–1.45)	1.45 (1.19–1.77)	1.24 (0.94–1.63)	1.39 (1.13–1.70)
Total hours/week‡	⩽50	1.00	1.08 (0.94–1.23)	1.00	1.25 (1.07–1.46)
	⩽75	0.97 (0.86–1.10)	1.08 (0.95–1.23)	1.13 (0.97–1.31)	1.42 (1.22–1.66)
	>75	0.94 (0.79–1.12)	1.22 (1.03–1.43)	1.26 (0.99–1.60)	1.56 (1.25–1.96)

*Adjusted for age, occupational status, type of work contract, type of work schedule, marital status, dependent children, consumption of alcohol, smoking, overweight, and sedentary lifestyle.
†Low: values 1–2; high: values 2.5–5.
‡Paid and domestic working hours and hours commuting.

Table 5 Adjusted* rate ratios and their 95% confidence intervals for medically certified sickness absences by the level of paid, domestic, and total working hours combined with the level of control over daily working hours (repeated measures Poisson regression GEE analyses according to work units) according to the type of work schedule (total population)

		Standard hours† Control over working hours§		Shift work‡ Control over working hours§	
		High n=9053 (46%)	**Low n=10 720 (54%)**	**High n=1648 (30%)**	**Low n=3854 (70%)**
Paid hours/week	⩽40	1.00	1.25 (1.19–1.31)	1.00	1.13 (1.04–1.23)
	⩽50	0.97 (0.90–1.04)	1.21 (1.12–1.30)	0.94 (0.81–1.10)	1.19 (1.04–1.36)
	>50	1.00 (0.86–1.16)	1.09 (0.96–1.25)	1.13 (0.85–1.51)	1.16 (0.93–1.45)
Domestic hours/week	⩽10	1.00	1.23 (1.14–1.34)	1.00	1.17 (0.98–1.38)
	⩽25	1.10 (1.02–1.18)	1.35 (1.25–1.45)	1.03 (0.87–1.22)	1.21 (1.03–1.48)
	>25	1.17 (1.06–1.29)	1.48 (1.36–1.62)	1.20 (0.96–1.50)	1.26 (1.04–1.51)
Commuting hours/week	⩽2.5	1.00	1.19 (1.12–1.26)	1.00	1.18 (1.04–1.34)
	⩽7.5	0.99 (0.93–1.06)	1.29 (1.21–1.37)	1.01 (0.88–1.16)	1.17 (1.03–1.32)
	>7.5	1.08 (0.96–1.22)	1.44 (1.32–1.59)	1.22 (0.97–1.53)	1.35 (1.15–1.57)
Total hours/week¶	⩽50	1.00	1.19 (1.07–1.31)	1.00	1.20 (0.97–1.50)
	⩽75	1.05 (0.96–1.14)	1.35 (1.24–1.47)	1.22 (1.01–1.48)	1.38 (1.14–1.68)
	>75	1.25 (1.10–1.41)	1.52 (1.36–1.71)	1.29 (0.96–1.73)	1.56 (1.24–1.95)

*Adjusted for age, gender, occupational status, type of work contract, marital status, dependent children, consumption of alcohol, smoking, overweight, and sedentary lifestyle.
†Weekdays, daytime only.
‡Work also on evenings/weekends/nights.
§Low: values 1–2; high: values 2.5–5.
¶Paid and domestic working hours and hours commuting.

supports the hypothesis that the health benefits of high perceived worktime control may stem from advantages in integrating the demands of work and home.[15 16]

The finding that low control over working hours also predicted self-certified sickness absences, especially among the men, raises the question of whether self-certified absences are used to pursue practical self-control over working times. Previously, sickness absence has been suggested to serve as a coping mechanism in adverse working conditions.[22] In our study, the men exposed to long total working hours took self-certified absences excessively if they had poor worktime control. One potential explanation for this finding is that excessive absences helped workers cope with the total workload.

Control over working hours had no special role as regards medically certified sickness absence among those with the longest hours in paid work. This finding is not surprising in that long paid hours were not associated with increased absences. Indeed, recent meta-analyses have shown that the health related effects of long working hours strongly differ according to the outcomes used. Effects have been found for subjective health, cardiovascular disease, diabetes, and disability retirement, whereas associations with sickness absence have been reversed.[1–3] It is possible that employees who work long paid hours are very committed to their work or are not easily replaced, and therefore they tend to work while ill and to take sick leave only when absolutely necessary. If this were the case, one would expect a stronger decline in short sickness absences than in long absences, for which unavoidable causes are more likely. Indeed, this is what we found. In addition, the well known healthy worker effect in epidemiological studies may contribute to the link between long paid hours and low absence rate; the healthiest employees may be continuously selected to work the longest hours.[23] Furthermore, these employees may also have rewarding jobs with health enhancing elements.[24]

Previously, the linearity of the health effects of paid working hours has been questioned, and potential thresholds determining the effects have been studied. Recent meta-analyses have indicated that working over 50 hours per week may carry health risks.[1 3] The present study provided evidence that neither moderately long working hours (over 40 to 50 per week) nor long working hours (over 50 per week) were associated with increases in sickness absenteeism. Unfortunately, we could not study thresholds above 50 hours per week as there were too few employees working very long hours (for example, over 55 hours per week).

Little evidence is available regarding whether long domestic working hours pose health risks. Associations with exhaustion, insomnia,[9] experiencing symptoms,[10] and depression[11] have been suggested. In our previous cross-sectional study, domestic working hours were linked with health problems and increased medically certified sickness absence among the men but not among the women.[12] In this follow-up study with a substantially larger sample, long domestic working hours predicted an increase in medically certified sickness absence similarly for the men and women. The well documented gender differences in the use of time[7 25] were replicated also in our study in that the men worked longer hours in paid work whereas the women's domestic working hours were considerably longer, resulting in longer total working hours for the women. Hence, we found evidence for differential exposure, but not for differential vulnerability.[26 8] The possible thresholds in the health effects of domestic working hours remain unclear. A U-shaped relation with psychological distress has been suggested.[26] Although we found a dose-response association between both domestic and total working hours and medically certified sickness absence among the women and men, more studies on the health effects of differential exposure levels are warranted.

Long commuting hours were associated with both types of sickness absences. Interestingly, an important target in the first organisational interventions promoting employee control over working times in the late 1960s was to reduce organisational losses caused by traffic problems.[27] Our results on self-certified absences suggest that this still is an important issue. Moreover, long commuting hours may pose health risks, for example by being a source of discomfort and stress as such, by reducing the time available for sleep and recovery, and by contributing to stress from conflicting demands from work and home.[13]

In evaluating the effects of the various types of working hours, we had the advantage of studying only full-time employees. Thus the findings were not biased by part-time work, which is perhaps the most important way to reduce total workload and reconcile paid work and family responsibilities at the European level.[28] However, as our sample was restricted to public sector employees with permanent or long term temporary work contracts, further research among private sector workers and temporary employees is needed to evaluate the generalisability of the findings.

Methodologically, one strength of our longitudinal design was the use of routinely collected objective data with which to measure sickness absence, the risk of selective recall bias and the subjectivity problem thus being minimised. Obviously, some of the sick leaves represent voluntary absenteeism not related to physical or mental illness,[29] and some employees work while ill and record no absences.[30] However, recent evidence suggests that data on medically certified sickness absence may be a useful measure for following day to day health prospects within and between employees. Medically certified sickness absence has been found to predict all-cause mortality more powerfully than established self-reported health measures and available objective measures of physical illnesses and medical conditions. It also strongly predicts several specific causes of death and early retirement.[31–33] In contrast, no such associations have been found for self-certified sickness absences. This evidence suggests that self-certified absences not only reflect minor health problems, but also behavioural patterns and/or organisational functioning, and it encourages the analysis of self and medically certified absences separately.

We assumed that perceived worktime control reflects the actual possibilities of influencing one's working times. In a large sample like ours, all of the various practices that give workers control over their working times could not be listed. It is nevertheless implausible that the perception of worktime control could depend on the characteristics of an individual only and be independent of work unit level regulations and circumstances. The extent to which the individuals' perceptions reflect contextual phenomena can be quantified by estimating intra-class correlations.[34] In our sample, the intra-class correlation of control over daily working hours assessments was 29.4%, indicating a high degree of homogeneity in the perceptions of worktime control within a work unit.

One limitation of our study, although difficult to avoid, was created by the use of self-reports for measuring working hours, since such reports are open to the confounding effects of social desirability. Especially domestic hours may have been over- or underestimated. Besides, actual working hours and desired working hours do not necessarily coincide,[28] and the degree of voluntariness—not measured per se—may have affected the vulnerability to long hours.[1] In the future, studying the effects of working hours in relation to differing orientations towards life domains, such as work or home or both, would appear worthwhile.[28]

Main messages

- Long domestic and total working hours were associated with increased rates of medically certified sickness absences, but not self-certified absences. No major gender differences emerged for these associations despite differences in the levels of domestic and total working hours between the men and women.
- Long commuting hours were related to increased rates of both medically and self-certified absences.
- The increase in sickness absences in conjunction with long domestic, commuting, and total working hours was reduced by high control over working hours.
- The sizes of the additive effects of the working hours and worktime control were modest, but since a large group of employees was affected they are of practical relevance in working life.

Policy implications

- Providing employees with control over working times may promote both employee health and the successful combination of full-time paid work with domestic responsibilities.

After adjustment for potential confounders, the observed additive effect of control over working hours with domestic and total working hours on sickness absence was not very strong. Nevertheless, since a large group of employees was affected, the combined effect is of practical relevance, at least for female dominated public sector employees. It has been suggested[35] that, in parallel with the healthy worker effect, the healthy spouse and healthy parent effect should be recognised. Had this been the case, the observed associations would have been underestimates rather than overestimates for this full-time working cohort.

Trends towards increasingly flexible and diverse working times are apparent in Western societies.[36] From the employers' point of view, flexible working times and overtime are desired to achieve better competitivity in the globalised economy. On the other hand, our results suggest that providing employees with control over their working times may reduce costs due to health related absenteeism.

To conclude, this large longitudinal cohort study showed that long paid working hours do not predict increases in sickness absences, whereas long domestic, commuting, and total hours do, among both women and men. High control over working hours was associated with reduced subsequent sickness absences, especially among women and men burdened with long domestic, commuting, and total working hours. These results imply that promoting employees' control over working hours may protect health and help workers successfully combine full-time paid work with the demands of domestic work.

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