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by [De Raeve L, Jansen NWH, Kant I](#)

Affiliation: Maastricht University, Department of Epidemiology, PO Box 616, NL-6200 MD Maastricht, Netherlands.
lore.deraeve@epid.unimaas.nl

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Health effects of transitions in work schedule, workhours and overtime in a prospective cohort study

by Lore De Raeve, MSc,¹ Nicole WH Jansen, PhD,¹ IJmert Kant, PhD¹

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Objectives The aim of this study was to examine the longitudinal relationship between transitions in work schedules, workhours and overtime and changes in several self-reported health outcomes (general health, fatigue, need for recovery, and psychological distress).

Methods Three-year follow-up data from the Maastricht Cohort Study on fatigue at work were used. Gender-stratified logistic regression analyses using generalized estimating equations were conducted for each of the dichotomized health outcomes, with control for a range of possible confounding factors.

Results In this study, transitions in worktime arrangements were prospectively related to changes in several self-reported health outcomes. Substantial and significant associations were found for transitions in work schedule and the incidence of prolonged fatigue and for the need for recovery among men. Moreover, transitions in work-hours affected the need for recovery among men, while they influenced general health and psychological distress among women. Finally, transitions in overtime were significantly associated with the incidence of the need for recovery among both men and women and with the incidence of psychological distress among men only.

Conclusions Transitions in worktime arrangements are related to changes in health, and studying transitions might be an important means of gaining insight into a possible causal relationship between employment and health. Given the considerable impact of worktime arrangements on the individual worker, employers, and society and the high frequency in which transitions within worktime arrangements can occur, these findings underline the need for interventions addressing worktime arrangements in order to reduce or prevent their impact on employee health.

Key terms employment; epidemiology; fatigue; longitudinal design; need for recovery; psychological distress; Netherlands; worktime arrangements.

The relationship between employment and health is frequently studied within the field of work and health. A large amount of research investigating the relationship between employment and health has focused on the impact of worktime arrangements, capturing different work schedules (day work versus various types of shift work), workhours, and overtime. Shift work, for example, has been shown to be associated with sleep loss, prolonged fatigue, mental health problems, cardiovascular disease, and gastrointestinal disorders (1–3). Working long hours or overtime has been shown to be associated with poor subjective health, more injuries, unhealthy behavior, and increased morbidity and mortality (1, 4–7).

The observed associations between worktime arrangements and health may primarily be explained by two mechanisms, the selection hypothesis and the

causation hypothesis. The causation hypothesis assumes that employment is causally related to health, while the selection hypothesis assumes that health determines the likelihood of finding or keeping a job (8–13). With respect to worktime arrangements, these hypotheses imply that worktime arrangements can have an effect on health or that health predicts the choice of a certain worktime arrangement. The general impression emerging from longitudinal research on this issue is that both hypotheses seem to be valid and reinforce each other sequentially (12, 14). Clear evidence of either hypothesis is, however, almost nonexistent as most of the studies in this field are cross-sectional in nature. However, even longitudinal studies are often unable to sort out selection and causation effects, among other things because of a lack of dynamics in exposure over time. On the basis of

¹ Department of Epidemiology, Maastricht University, Maastricht, Netherlands.

Reprint requests to: Lore De Raeve, Maastricht University, Department of Epidemiology, PO Box 616, NL-6200 MD Maastricht, Netherlands. [E-mail: lore.deraeve@epid.unimaas.nl]

guidelines for causal inference (15, 16), we can assume that a change in exposure (ie, a change in worktime arrangements) results in an altered outcome (ie, health). Therefore, studying the relationship between transitions in worktime arrangements and changes in health may be the key to gaining information on the causation effect, as the transition creates a new situation and consequently enables the study of a direct change in health.

Overall, literature on transitions in worktime arrangements is very scarce. A study by Jansen et al (3) found that shift workers changing to daywork reported significantly higher levels of fatigue prior to their change when compared with those remaining in shift work. Shields (17) examined the relationship between changes in workhours and changes in health behavior. She concluded that a transition from standard workhours to long workhours was associated with increased smoking among men and women, increased drinking among women, and unhealthy weight gain among men.

If the net health effect of transitions in worktime arrangements is to be studied, the influence of possible confounding factors must be taken into account. Several studies have shown that the association between worktime arrangements and health may depend on demographic variables, work and home characteristics, and personality factors (4–6). With respect to work schedules, differences between day and shift workers have been reported (18, 19). Moreover, Jansen et al (3) stated that perceived work characteristics may play an important role in the relationship between work schedules and fatigue. In addition, the relationship between worktime arrangements and health may differ between men and women because of differences in role patterns and labor force participation between the genders and their different expectations and choices regarding the division of time spent at work or with family.

On the basis of the literature indicating that shift work, long workhours, and overtime are associated with considerable adverse health effects, we hypothesized that (i) a transition from shift work to daywork is beneficial for health, (ii) reducing the number of workhours per week is favorable for health, and (iii) quitting overtime work is beneficial for health. We expected that the effects of the transitions would depend both on the health outcomes studied and the time span within which the outcome is measured. It is possible that some health outcomes respond differently or more quickly over time than others to a certain transition.

The aim of this study was to examine the relationship between transitions in work schedules (shift work versus daywork), workhours, and overtime and changes in several health outcomes (self-reported general health, fatigue, need for recovery, and psychological distress), separately for men and women, while controlling for a range of possible confounding factors. Data from the

Maastricht Cohort Study on fatigue at work were used to address this aim in a longitudinal design. Both transitions in worktime arrangements and changes in health were studied within 1 year of follow-up.

Study population and methods

Study population

This study was based on data from the Maastricht Cohort Study, a prospective study on fatigue at work (20) in which employees from 45 companies were followed by means of nine self-administered questionnaires, which they received at 4-month intervals. Once a year, in May, the employees received an extensive questionnaire with items on work- and nonwork-related factors, demographics, and health factors. Twice a year (in September and January) the employees received a short questionnaire, capturing mainly outcome measures. In May 1998, the baseline questionnaire was sent out to 26 978 employees. Altogether, 12 161 completed and returned the baseline questionnaire (response rate of 45%). Twenty-one questionnaires were excluded from the analysis for technical reasons. The baseline (T_0) cohort for this study thus consisted of 12 140 people and included both blue-collar and white-collar workers. Detailed information on the sectors and trades represented in the Maastricht Cohort Study and on nonresponse has been reported elsewhere (3, 20). The employees who had completed the baseline questionnaire and at least one of the following two short questionnaires (T_1 and T_2) received the 1-year follow-up questionnaire (T_3) in May 1999 (response rate 79.5%, N=9655). The employees who returned the questionnaire at T_3 and at least one of the consecutive short questionnaires (T_4 and T_5) also received the extensive questionnaire (T_6) in May 2000 (response rate 66.5%, N=8070). For the purpose of this study, data from T_0 , T_3 , and T_6 were used.

The data were pooled in order to maximize the number of transitions and hence also the power and statistical significance of the study. Consequently, information from two transition periods was combined. For the transition period between T_0 and T_3 , T_0 was identified as the baseline measurement, while T_3 was called the follow-up measurement. With regard to the transition period between T_3 and T_6 , T_3 was identified as the baseline measurement, while T_6 was called the follow-up measurement. The pooling thus resulted in two measurement points: time T and time T+1. In the remainder of this paper these measurement points have been referred to as the baseline measurement and the follow-up measurement, respectively. Changes from the baseline measurement to the follow-up

measurement were used to determine the existence of a transition in worktime arrangements. Changes in the self-reported health outcomes were determined by assessing incident cases of the health outcomes at follow-up. Therefore, all prevalent cases at baseline were excluded.

From this pooled cohort, the employees with multiple jobs were excluded, since information about worktime arrangements and job content of other jobs was lacking. In addition, only the employees working 36 to 40 hours per week at the time of the baseline measurement were selected, as a full-time workweek in the Netherlands generally consists of 36 to 40 hours. Moreover, this selection was made to increase comparability with respect to workhours. The resulting study population was called study population A, consisting of 10 888 employees. Transitions in work schedule (daywork versus shift work) were studied within this population. To study the effects of transitions in workhours and overtime, an additional selection of this cohort was made. Only the employees involved in daywork at the time of both the baseline and follow-up measurements were selected. This additional selection resulted in study population B, consisting of 6271 employees. The baseline characteristics of study populations A and B are presented in table 1.

Measures

Worktime arrangements. The employees provided information about several aspects of their worktime arrangements, like work schedule, workhours, and overtime work. Work schedule captured daytime versus shift work. In this study, daywork comprised normal workhours between 0700 and 1900. Shift work captured two-shift, three-shift, four-shift, five-shift, and irregular shift work. No further distinction was made between shift work with and without frequent nightwork. Regarding workhours, the employees were asked for their workhours per week. As has already been described, all of the employees who were selected worked 36 to 40 hours per week at the time of the baseline measurement.

The number of workhours per week at the time of the follow-up was recoded as <36 hours, 36 to 40 hours and >40 hours per week. This information was used to track transitions in workhours per week between the baseline and follow-up measurements. Finally, overtime was assessed by asking the employees whether they frequently worked overtime (yes/no).

Health outcomes. Self-rated general health was measured using one item from the SF-36 (21), giving an overall rating of health on a 5-point scale (1=excellent, 2=very good, 3=good, 4=moderate, 5=bad). In line with several other studies (22–25), this measure was dichotomized by grouping response scores 1–3 into the category of good general health and scores 4–5 into the category of poor general health.

The need for recovery from work was assessed using an 11-item scale from the Dutch Questionnaire on the Experience and Evaluation of Work [Dutch abbreviation VBBA] (26, 27). The items represent short-term effects of a day of work. The total score ranged from 0 to 100 (Cronbach's alpha 0.78). As no cut-off point existed for classifying persons with a high score on the total scale, we used the upper tertile to define employees with a considerable need for recovery from work, the so-called need-for-recovery cases.

Prolonged fatigue was measured with the Checklist Individual Strength (CIS), a 20-item questionnaire developed to measure several aspects of prolonged fatigue (28). Whereas the scale for need for recovery measured the recuperation period after 1 day of work and thus represented short-term effects, the CIS asks employees how they felt during the past 2 weeks. The CIS is a self-report instrument consisting of the following four subscales: subjective experience of fatigue (8 items), concentration (5 items), motivation (4 items), and physical activity level (3 items). The items of the CIS are scored on 7-point Likert scales. Higher scores indicate a higher degree of fatigue, lower levels of concentration, reduced motivation, or less activity. A composite CIS total score, ranging from 20 to 140, was constructed by adding the individual's scores on the four factors. The

Table 1. Baseline characteristics of study populations A and B. (PJD = psychological job demands, DL = decision latitude, CSS = co-worker social support, SSS = supervisory social support, SW = shift work, OT = frequent overtime, GH = self-reported general health poor, NFR = need for recovery case, PF = prolonged fatigue case, PD = psychological distress case)

Variables	Male gender (%)	Age		Education (%)		PJD (12–48 ^a)	DL (24–96 ^a)	CSS (4–16 ^a)	SSS (4–16 ^a)	SW (%)	OT (%)	GH (%)	NFR (%)	PF (%)	PD (%)
		Mean	SD	Low	Medium	High									
<i>Study population A (N=10888)</i>															
	84.1	41.73	8.96	23.1	46.1	30.8	32.85	5.64	71.37	11.17	11.81	1.60	10.33	2.36	27.9
<i>Study population B (N=6271)</i>															
	82.5	43.07	8.56	12.8	45.5	41.7	32.57	5.48	73.49	9.91	11.83	1.48	10.49	2.22	0

^a Scale range.

Cronbach's alpha of the total CIS scale in our study was 0.93. Persons scoring >76 were designated as probable cases of prolonged fatigue (29).

Psychological distress was measured using the 12-item version of the General Health Questionnaire (GHQ) (30, 31). The employees scoring ≥4 on the 12 GHQ-items were considered to be probable cases of psychological distress.

Confounding factors. Information on age, gender, and educational level was obtained through self-report in the baseline (T_0) questionnaire. Moreover, psychological job demands, decision latitude, and social support at work were measured at baseline by a Dutch version of the Job Content Questionnaire (32, 33). Psychological job demands were assessed by the sum of five items (Cronbach's alpha 0.69). Decision latitude (Cronbach's alpha 0.81) was measured by the sum of the following two subscales: skill discretion and decision authority. The response options varied from strongly agree to strongly disagree on a 4-point scale. Social support was assessed by the following two scales, each consisting of four items: supervisory support (Cronbach's alpha 0.85) and co-worker support (Cronbach's alpha 0.75). Physical demands were measured with a 1-item question "Would you consider your work to be physically demanding?" (34). Furthermore, functional mobility was defined as a change in job function between T_0 and T_3 and included as a confounder in the model. As such, it was possible to study the health effects of changes in worktime arrangements independent of changes in job function.

Statistical analysis

We used logistic regression analyses for repeated measurements (generalized estimating equations) to assess the relationship between transitions in worktime arrangements from time T to time $T+1$ and changes in several self-reported health outcomes from T to $T+1$. Generalized estimating equations (GEE) can be used as a method for dealing with correlated data arising from repeated measurements (35, 36). First, all

prevalent cases from the involved dependent variable at baseline were excluded. As such, only incident cases for each health outcome were studied. Separate logistic regression models were fitted for each of the following dichotomized health measures: self-reported general health, prolonged fatigue, need for recovery, and psychological distress. Odds ratios (OR) and 95% confidence intervals (95% CI) were calculated. In the analyses, we corrected for age (continuous), education, functional mobility, psychological job demands, decision latitude, social support of co-workers and supervisors, and physical demands of the job. We also examined the influence of smoking behavior and changes in other worktime arrangements as possible confounders, but, as they did not imply a relevant change in the regression coefficient, they were omitted from the analyses. All of the analyses were stratified for gender and were performed using SAS 9.1 statistical packages (35).

Results

Transitions in work schedules

The associations between transitions in work schedules and changes in self-reported health were calculated for the employees working 36–40 hours per week, either in daywork or in shift work at the time of the baseline measurement (study population A). Because of the small number of women in each transition category, the analyses were performed for the men only (table 2). The results of the GEE analysis showed that the men working in shifts at the time of both the baseline and follow-up measurements had significantly higher odds of developing a higher need for recovery, more prolonged fatigue, or poor general health than the men in daywork at the time of both the baseline and follow-up measurements. After correction for confounders, all of the odds ratios lacked significance. In addition, the men changing from shift work to day work had significantly higher odds of becoming a need-for-recovery case or a psychological

Table 2. Health effects of transitions in work schedules among the men (study population A). (A = daywork, B = shift work)

Work schedule ^a	Fatigue case				Poor general health				Need for recovery case				Psychological distress case							
	N	OR ^b	95%CI ^b	OR ^c	N	OR ^b	95%CI ^b	OR ^c	N	OR ^b	95%CI ^b	OR ^c	N	OR ^b	95%CI ^b	OR ^c				
A→A	3583	1.00	·	1.00	·	3892	1.00	·	1.00	·	2986	1.00	·	1.00	·	3623	1.00	·	1.00	·
B→A	95	1.39	0.82–2.38	1.03	0.55–1.90	117	0.89	0.46–1.71	0.65	0.31–1.33	64	2.50	1.47–4.26	2.12	1.19–3.75	101	1.79	1.14–2.80	1.62	0.99–2.67
B→B	1045	1.40	1.16–1.70	1.25	0.98–1.59	1197	1.41	1.15–1.71	1.22	0.95–1.58	809	1.41	1.15–1.73	1.10	0.85–1.43	1095	0.92	0.76–1.11	0.89	0.70–1.13
A→B	43	2.33	1.22–4.44	2.43	1.18–5.01	45	1.54	0.70–3.39	1.46	0.59–3.63	29	1.40	0.59–3.29	1.31	0.52–3.32	42	0.51	0.19–1.41	0.67	0.23–1.89

^a Baseline → follow-up.

^b Uncorrected.

^c Corrected for age (continuous), education, functional mobility, psychological job demands, decision latitude, supervisory support, co-worker support, and physical demands.

distress case than the men in daywork. In the fully corrected model, the odds ratio for psychological distress lacked significance. Finally, the men changing from daywork to shift work had considerably higher and significant odds of becoming a prolonged fatigue case, even in the fully corrected model.

Transitions in workhours

The health effects of transitions in workhours were calculated for both the male and female employees working 36–40 hours per week in daywork at the time of the baseline measurement (study population B). As shown in tables 3 and 4, a rather high number of both the men and the women underwent a transition in their workhours from the baseline to the follow-up measurement (note: the different numbers of included observations resulted from missing observations in the outcome variables or in the confounders). Table 3 shows that the male employees changing from 36–40 hours per week to >40 hours per week had significantly higher odds of experiencing an elevated need for recovery from the baseline to the follow-up measurement (OR 1.48, 95% CI 1.09–2.01) than the men who did not change the number of hours they worked per week. The odds for the other health outcomes were not significant.

The associations between transitions in workhours and changes in self-reported health outcomes for the women are presented in table 4. The transition from

36–40 hours per week at the time of the baseline measurement to <36 hours per week at the time of the follow-up measurement was significantly associated with a deterioration in self-reported general health (OR 2.59, 95% CI 1.33–5.03) and more psychological distress (OR 1.99, 95% CI 1.18–3.35) than working 36–40 hours per week at the time of both the baseline and follow-up measurements. The association between a change in workhours from 36–40 hours per week at baseline to >40 hours per week at follow-up and a deterioration in self-reported health was only borderline significant (OR 1.97, 95% CI 0.99–3.91).

Transitions in overtime

As for transitions in workhours, transitions in overtime were also calculated for the male and female employees working 36–40 hours per week in daywork at the time of the baseline measurement (study population B). As shown in table 5, a fairly large number of both the men and the women experienced a transition in overtime work. These transitions were significantly related to changes in the need for recovery and psychological distress only. Working overtime at the time of both the baseline and follow-up measurements was significantly associated with a decreasing need for recovery (OR 0.58, 95% CI 0.36–0.93) and less psychological distress (OR 0.69, 95% CI 0.49–0.98) among the men. Having quit overtime work by the time of the follow-up measurement

Table 3. Health effects of transitions in workhours among the men (study population B). (A = 36–40 hours/week, B = >40 hours/ week, C = <36 hours/ week)

Work-hours/ week ^a	Fatigue case				Poor general health				Need for recovery case				Psychological distress case							
	N	OR ^b	95%CI ^b	OR ^c	N	OR ^b	95%CI ^b	OR ^c	N	OR ^b	95%CI ^b	OR ^c	N	OR ^b	95%CI ^b	OR ^c	95%CI ^c			
A→A	2916	1.00	.	1.00	.	3180	1.00	.	1.00	.	2474	1.00	.	1.00	.	2955	1.00	.	1.00	.
A→B	589	0.96	0.73–1.26	0.95	0.70–1.29	628	0.97	0.73–1.31	0.96	0.69–1.35	446	1.47	1.13–1.91	1.48	1.09–2.01	588	0.88	0.68–1.12	0.79	0.60–1.05
A→C	74	1.27	0.69–2.35	1.37	0.69–2.72	79	1.01	0.49–2.09	0.78	0.31–1.95	63	1.04	0.52–2.10	1.37	0.64–2.92	76	1.01	0.56–1.83	1.07	0.56–2.04

^a Baseline → follow-up.

^b Uncorrected.

^c Corrected for age (continuous), education, functional mobility, psychological job demands, decision latitude, supervisory support, co-worker support, and physical demands.

Table 4. Health effects of transitions in workhours among the women (study population B). (A = 36–40 hours/week, B = >40 hours/ week, C = <36 hours/ week)

Work-hours/ week ^a	Fatigue case				Poor general health				Need for recovery case				Psychological distress case							
	N	OR ^b	95%CI ^b	OR ^c	N	OR ^b	95%CI ^b	OR ^c	N	OR ^b	95%CI ^b	OR ^c	N	OR ^b	95%CI ^b	OR ^c	95%CI ^c			
A→A	570	1.00	.	1.00	.	620	1.00	.	1.00	.	490	1.00	.	1.00	.	549	1.00	.	1.00	.
A→B	68	1.32	0.72–2.41	1.71	0.90–3.24	76	1.88	0.99–3.57	1.97	0.99–3.91	55	1.64	0.86–3.15	1.62	0.80–3.28	67	1.27	0.72–2.24	1.31	0.72–2.41
A→C	75	1.06	0.58–1.95	1.20	0.62–2.31	91	2.05	1.15–3.64	2.59	1.33–5.03	60	0.62	0.26–1.45	0.60	0.23–1.56	84	1.85	1.14–2.98	1.99	1.18–3.35

^a Baseline → follow-up.

^b Uncorrected.

^c Corrected for age (continuous), education, functional mobility, psychological job demands, decision latitude, supervisory support, co-worker support, and physical demands.

Table 5. Health effects of transitions in overtime among the men and women (study population B). (A = no overtime, B = overtime)

Overtime ^a	Men										Women									
	Need for recovery case					Psychological distress case					Need for recovery case					Psychological distress case				
	N	OR ^b	95%CI ^b	OR ^c	95%CI ^c	N	OR ^b	95%CI ^b	OR ^c	95%CI ^c	N	OR ^b	95%CI ^b	OR ^c	95%CI ^c	N	OR ^b	95%CI ^b	OR ^c	95%CI ^c
A→A	1619	1.00	.	1.00	.	1860	1.00	.	1.00	.	339	1.00	.	1.00	.	357	1.00	.	1.00	.
A→B	252	1.19	0.82–1.72	1.31	0.87–1.98	305	1.28	0.94–1.73	1.16	0.83–1.64	49	1.62	0.77–3.39	1.47	0.64–3.38	57	1.15	0.62–2.13	0.81	0.40–1.62
B→A	774	1.50	1.18–1.89	1.63	1.23–2.15	1044	0.99	0.80–1.22	0.82	0.64–1.05	149	2.32	1.43–3.76	1.96	1.04–3.69	199	1.20	0.81–1.77	1.00	0.63–1.59
B→B	320	0.52	0.33–0.82	0.58	0.36–0.93	391	0.79	0.57–1.08	0.69	0.49–0.98	68	0.47	0.17–1.33	0.44	0.15–1.27	86	0.88	0.49–1.55	0.69	0.37–1.29

^a Baseline → follow-up.^b Uncorrected.^c Corrected for age (continuous), education, functional mobility, psychological job demands, decision latitude, supervisory support, co-worker support, and physical demands.

was associated with significantly higher odds of becoming a need-for-recovery case among both the men (OR 1.63, 95% CI 1.23–2.15) and the women (OR 1.96, 95% CI 1.04–3.96) than not working overtime at both measurement points.

Discussion

Our study examined the association between transitions in various types of worktime arrangements and changes in self-reported health outcomes in order to gain more insight into a possible causal relationship between employment and health. This study showed that transitions in worktime arrangements are prospectively related to changes in several self-reported health outcomes. The results varied for different transitions and the different health outcomes studied. Moreover, considerable gender differences were observed. Substantial and significant relationships were found between transitions in work schedule and the incidence of prolonged fatigue and need for recovery among the men. Moreover, transitions in workhours affected the need for recovery among the men, while they influenced both self-reported general health and psychological distress among the women. Finally, transitions in overtime were significantly associated with a change in the need for recovery among the men and women and with a change in psychological distress among the men only. As studying transitions is fairly complicated, several methodological and conceptual issues should be addressed.

In our study, a follow-up period of 1 year was chosen. Shorter measurement periods would have probably resulted in a clearer insight into the time course of cause and effect (37). Despite the frequent sampling (every 4 months) used in the large-scale Maastricht Cohort Study, we were not able to study transitions that took place within these short periods of time, as items on specific worktime arrangements were only assessed in

the extensive questionnaires that were sent out yearly. Therefore, the specific time period in which the transition took place could not be clearly defined. We do know, however, that the transition took place presumably after an average of 6 months after the baseline measurement. As we do not exactly know when the transition took place, it is also not clear whether the health effect of the transition had not yet occurred or whether the effect had already faded away. For instance, the women changing to fewer hours per week might not yet have adapted to their new workhours and consequently no effect was found (yet). A related issue is that the time span within which an effect can occur is probably related to the health outcome under study. Some outcomes may react faster to a certain transition than others. As was indicated by Jansen et al (3), it is possible that the effects of shift work on fatigue develop relatively soon after work in a shiftwork job has started, while the effects on other health outcomes have not yet occurred. In addition, the differences found for the separate health outcomes may also have been due to our choice of arbitrary cut-off points. To date, there are no existing cut-off points for classifying employees with a marked need for recovery that would put them at risk for future health problems. In our study, the upper tertile was used to define employees with a considerable need for recovery from work, the so-called need-for-recovery cases. So far, this procedure has appeared to be a good method since the distribution of need for recovery in the cohort covered the whole range of the scale and showed no cut-off points or peculiarities.

In our study, the employees were already in the middle of an ongoing process both with regard to worktime arrangements and health. In this respect, our first measurement was not a true baseline measurement. Previous worktime arrangements and transitions that had taken place in the past may have already had their influence on the health of the respondents before our actual baseline measurement. Consequently, a selection bias may have already occurred before our first measurement. People

working overtime may have stopped working overtime before the baseline measurement due to mental health problems. This possibility may be an explanation for the fact that the men working overtime both at the time of the baseline measurement and at the time of the follow-up measurement reported a significantly lower need for recovery and less psychological distress than the men not working overtime. A specific type of selection bias is the healthy worker effect. For example, it is possible that only employees able to withstand the effects that accompany shift work start working shifts or remain in shift work. This possibility could be an explanation for the fact that the transition from daywork to shift work in our study was not significantly associated with a change in self-reported health outcomes like perceived general health, need for recovery, and psychological distress. Moreover, the fact that the employees who started working overtime did not experience a significant deterioration in health may have also been due to this healthy worker effect. In this study, we minimized the selection effects by studying individual changes in worktime arrangements in relation to individual changes in health.

The results of our study indicate that transitions that were hypothesized to have positive health effects were not always associated with a positive change in mental health. For example, when women changed their workhours to <36 hours per week, the change did not prevent them from becoming psychologically distressed, a finding which was not in line with our hypothesis. This effect could have been due to other changes in the work or home situation that we did not control for in the analyses. With respect to work–family conflict, Jansen et al (38) found that full-time working women with high work–home interference had a substantially higher probability of changing their workhours over time than those reporting lower work–home interference. In this respect, it is possible that, despite a reduction in workhours, the women in this study still experienced negative effects of a double burden and therefore became psychologically distressed. In this view, a potentially important confounder is whether changes in worktime arrangements were forced upon the employee, more likely leading to negative effects, or whether they were the worker's own choice, possibly leading to more positive effects (39, 40). For example, an obligation to reduce the amount of workhours because of company restructuring can be an important source of psychological distress. Although an item in the questionnaire specifically asked whether or not the change in workhours was at the employee's own request, we were unable to make this distinction due to the low number of participants responding to this item. For the same reason, in this study, no further distinction could be made regarding the amount of overtime or the size of the change in workhours. It is possible, however, that a limited amount of overtime or

a small change in workhours has a limited influence on health and that more severe levels of overtime or larger changes in workhours must be reached before health consequences appear. Regarding the external validity of our study, it should be mentioned that this study only applied to full-time employees. Mechanisms and choices related to worktime arrangements will probably differ for part-time workers, for whom several selection processes may have already taken place.

Another issue concerns the correction for confounding in our study. As was already mentioned in the introduction, the relationship between worktime arrangements and health may be confounded by several factors that we controlled for in our analyses. Work-related factors, like job demands, are very interrelated with worktime arrangements. For example, it is possible that shift workers perceive their job as more demanding than day workers do. As such, controlling for these work-related factors may have led to overcontrol and hence to an underestimation of the observed relationships.

Contrary to our hypothesis, quitting overtime work was associated with a higher need for recovery among both the men and the women than not working overtime was. Our explanation for this counterintuitive result stems from Kristensen et al (41), who suggested that the pressure for increased productivity may result in a mismatch between the amount of work that needs to be done and the time available to do it. This mismatch leads to pressure for both a faster workspace (intensity of work) and longer workhours (extensity of work). It goes without saying that both could lead to a deterioration of health. What might have happened in our study is that these people had already intensified their work and, in consequence, they experienced a higher need for recovery at that point in time. When they subsequently intensified their work by working overtime, the need for recovery may have increased even more. Quitting overtime work may then only have reduced the need for recovery to the level of the effect that the intensification had already had on the need for recovery.

To our knowledge, this is the first prospective study examining the relation between transitions in various worktime arrangements and changes in four self-reported health outcomes (self-reported general health, need for recovery, prolonged fatigue, and psychological distress) in a general working population. Although this study used a longitudinal approach, it was methodologically not possible to draw any conclusions about causality as the change in exposure was measured at the same time as a change in the outcome measures. This study clearly showed that individual transitions within employment are related to individual changes in self-reported health outcomes. As the transition creates a new situation, consequently enabling a direct change in health to be studied, we do think that studying transitions may be

an important means with which to gain more insight into a possible causal relationship between employment and health. Given the considerable impact of worktime arrangements on the individual worker, employers, and society and the high frequency in which transitions within worktime arrangements can occur, these findings underline the need for interventions addressing worktime arrangements in order to prevent, or at least reduce, their impact on the health of the working population. Moreover, it is important to pay substantial attention to employees' expressed requests for changing their worktime arrangements, as they can be an antecedent of a future change in health, as well as an effect of already changed health.

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