Effects of new ways of working on work hours and work location, health and job-related outcomes

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\begin{abstract}
New ways of working (NWW) is a type of work organization that is characterized by temporal and spatial flexibility, often combined with extensive use of information and communication technologies (ICT) and performance-based management. In a three-wave intervention study, we examined the effects of NWW on both the organization of work (changes in control over time and place of work; working hours and work location; and other key job characteristics), and on employees’ outcomes (work–nonwork balance; health and well-being; and job-related outcomes). We applied a quasi-experimental design within a large Dutch financial company ($N=2,912$). We studied an intervention group ($n=2,391$) and made comparisons with a reference group ($n=521$). There were three study waves: (i) one/two months before, and (ii) 4 months and (iii) 10 months after implementation of NWW. Repeated measures analyses of covariance (involving 361 participants from the intervention group and 80 participants from the reference group) showed a large and significant shift from hours worked at the office to hours worked at home after implementation of NWW. Accordingly, commuting time was reduced. Employees remained working on week days and during day time. Psychosocial work-characteristics, work–nonwork balance, stress, fatigue, and job-related outcomes remained favourable and largely unaffected, but the health score in the intervention group decreased (medium effect). These findings suggest that the implementation of NWW does not necessarily lead to changes in psychosocial work characteristics, well-being or job-related outcomes.
\end{abstract}

\textbf{KEYWORDS}
Work-home interference; boundaryless work; well-being; work-nonwork balance; flexible work; intervention

\section*{Introduction}
Modern technologies heavily impact the organization of work. Information and communication technology (ICT) devices allow many employees to work anywhere, anytime (Allvin et al., 2011; Kompier, 2006). To recruit and retain valuable employees, organizations need to accommodate preferences of a more diverse workforce. These developments have led to a new, more flexible approach in organizing work, i.e. to create time and place-independent work environments that aim at innovation and productivity while simultaneously accomplishing cost reductions. This new approach to the organization of work is coined “New Ways of Working” (NWW; Baane et al., 2011).

NWW is a type of work organization that is characterized by a combination of temporal and spatial flexibility (e.g. Baane, et al., 2011; Blok et al., 2011). Temporal flexibility means that employees, within certain boundaries, can self decide how to distribute their contractual work hours over different times of the day and (seven) days of the week. Spatial flexibility means that employees, again within certain boundaries, have the possibility to perform their work from different workplaces, for example, from a flexible office, from home and/or from other remote locations. We define NWW as ‘Time and place-independent work, often combined with extensive use of ICT and performance based management’. ICT is important for accessing information and communication between employees at various work locations. Steering on performance (clear targets) is important because there is less face to face interaction between supervisors and employees. From this definition it is clear that there is not one type of NWW. Instead, NWW comes in many qualities, depending on, for example, the actual boundaries that are set by the company, ergonomic design of workplaces, and availability and utilization of ICT. NWW may also come in many quantities, which may, for example, depend on the number of flexible workstations at
the office, or the number of days that employees are stimulated, expected or required to work from home.

According to the ‘sunny perspective on NWW’, increased autonomy over work could improve employees’ motivation (e.g. Hackman & Oldham, 1976; Pritchard & Payne, 2003) and thereby increase organizational performance. High worktime control can improve the fit between employees’ work and private-life (e.g. Beckers et al., 2012; Nijp et al., 2015) and may allow employees to align their work schedule with their chronotype (Wittman et al., 2006). Flexible use of office space and digitalization of information may allow cost reductions and increase work efficiency or information sharing (e.g. Demerouti et al., 2014; Peponis et al., 2007). Working from home is helpful in reducing commuting time, commuting costs and environmental pollution (Manoochehri & Pinkerton, 2003) and may help employees to combine work and family obligations (Gajendran & Harrison, 2007).

Other scholars endorse a more ‘gloomy perspective’. They point at potential downsides of NWW: loss of social support from colleagues when working from home (Halford, 2005), increased stress due to high responsibility, constant connectivity to work and loss of structure (e.g. Allvin et al., 2011; Mazmanian et al., 2013). Also long work hours or blurring boundaries between work and private life could compromise work–life balance, recovery from work, and work performance (e.g. Demerouti et al., 2014; Lundberg & Cooper, 2010; Popma, 2013).

Various studies have been conducted on the effects of separate NWW aspects ‘in isolation’: studies on telework (e.g. Gajendran & Harrison, 2007; Mann & Holdsworth, 2003), worktime control (e.g. Nijp et al., 2012), or flexible office designs (e.g. De Croon et al., 2005; Danielsson et al., 2014). Such studies provide little insight in the effects of simultaneous implementation of these NWW aspects (De Menezes & Kelliher, 2011). Moreover, they often do not address the nature (i.e. self-chosen vs. obligatory place- and time independent working) and extent of flexibility offered (Gajendran & Harrison, 2007). Also, they offer little insight into ‘process’ issues, i.e. into the ways NWW aspects are introduced and implemented. Therefore, there is a need to thoroughly examine the effects of NWW as multifaceted intervention on employees’ outcomes, such as work–home interference (WHI), health and well-being, and job-related outcomes.

Until now, only three intervention studies examined effects of a broad NWW intervention (Blok et al., 2012; Meijer et al., 2009; Vink et al., 2012). All three showed inconsistent effects on health or fatigue and productivity (Blok et al., 2012; Meijer et al., 2009; Vink et al., 2012). One study (Blok et al., 2012) showed indications of increased access to flexible work hours, ICT facilities and remote accessibility of information but also of reduced knowledge-sharing and NWW-consistent management. It showed no effects on collaboration and work satisfaction. These findings suggest that NWW may have positive as well as null or negative effects, and that apart from a focus on more distal outcomes such as health and job-related outcomes it is relevant to examine whether NWW actually leads to presumed changes in the organization of work (i.e. more proximal changes).

The scarce previous research on NWW is not without methodological flaws. Studies either lacked a control group (Blok et al., 2012; Meijer et al., 2009), lacked statistical information (Vink et al., 2012), provided limited information on the implementation background, content or process (i.e. ‘what really happens’; Kristensen, 2005), included small samples and/or did not test the changes in basic work characteristics that are presumed to change after the intervention (i.e. ‘manipulation-check’ regarding worktime- and workplace flexibility). Finally, each of these studies focused on a limited number of outcomes of NWW. Such shortcomings prevent firm conclusions on the effects of NWW on the organization of work and on health and well-being.

Despite the increasing popularity of NWW (Ouye et al., 2012; Van der Meulen, 2014), research into its effects is thus still in its infancy. In the current intervention study, we aim to provide a broad overview of the effects of NWW on both the organization of work (i.e. changes in control over time and place of work, working hours and work location, and other job characteristics), and on employees’ outcomes (i.e. work–home interference, health and well-being, and job-related outcomes).
The current study

In order to provide an overview of the effects of implementing NWW, we conducted a three-wave intervention study within a large Dutch financial company, and assessed a broad range of theoretically relevant outcomes. By closely monitoring the implementation process of NWW, and by applying a strong intervention design, we aim to address the shortcomings of previous studies. Our first research question is:

RQ1a. What are the effects of NWW on employees’ control over worktime and workplace, and on employees’ work hours and work location?

We expect the implementation of NWW to result in higher levels of worktime control (i.e. employees’ possibilities to work when they want; WTC) and of work location control (i.e. employees’ possibilities to work where they want; WLC). Higher levels of such control could lead to higher satisfaction with- and use of WTC and WLC (Nijp et al., 2015). In line with this, we expect NWW to result in more time spent working at home, a decrease in time spent at the office, and a reduction in commuting time. Increased flexibility in working times could also lead to more time spent working in the evening or weekend. We also want to find out whether NWW influences the number of weekly work hours.

RQ1b. What are the effects of NWW on the psychosocial work environment?

The effects of NWW on the more general psychosocial job characteristics (i.e. general autonomy, work demands and social support) are difficult to predict. For example, increased use of ICT stimulates communications among colleagues (Demerouti et al., 2014), but working from home may also reduce informal face-to-face meetings. Performance-based management may raise work demands, but use of ICT devices could help to perform work more efficiently. In the absence of clear theoretical indications, we do not formulate specific expectations with regards to RQ1b.

Our second research question is:

RQ2. What are the effects of NWW on employees’ work–home interference, health and well-being, and job-related outcomes?

If the implementation of NWW impacts the organization of work (RQ1a and 1b), it could also have consequences for (i) employees’ WHI, (ii) health and well-being (in this study: stress, fatigue, and general health), and (iii) job-related outcomes (i.e. organizational commitment, performance and job satisfaction). Because the effects of NWW on the organization of work (RQ1) are yet largely unknown, and because both beneficial as well as detrimental effects of NWW on employees’ outcomes are plausible, we do not formulate specific expectations for these three sets of outcomes.

Method

Intervention

Objectives

This intervention study was conducted within a large, Dutch financial and insurance company. The company’s overall aim was (i) to improve organizational efficiency by reducing costs and improving productivity, and (ii) to raise employee and customers’ satisfaction with work. The company hoped to improve employees’ job satisfaction and their work–nonwork balance, to reduce stress and sickness absence, and to improve performance. The digitalization of information (i.e. paperless office) and intended reduction in daily commuting were supposed to benefit the environment, and consequently the organization’s imago. At the same time, with employees working from home for a substantial proportion of time, the organization aimed to reduce costs related to office rent, electricity, cleaning, parking space and commuting. Digitalization of work was expected to result in lower printing costs. The implementation of NWW was thus meant to be beneficial for both the company and the individual employee.
Implementation background
The implementation of NWW was authorized and supported by top-management. A multi-disciplinary work group was installed as ‘motor’, and an external consultancy firm was hired to assist management and this work group. NWW participation was obligatory for all departments and employees. Several short courses or workshops were offered to both employees and managers to familiarize them with NWW. Initially, these courses were obligatory, later employees could self-decide upon participation. Each employee received a budget of 500 EUR to facilitate such training. As the implementation of NWW was a complex process, implementation occurred group-wise, over a six-year period (i.e. department by department, between 2008 and 2014).

Implementation of NWW started in 2008 with pilot projects at the main office. All other departments followed, involving about 7,000 employees at various office locations throughout the country. Two departments at isolated locations, where implementation of NWW was meant to start later, served as reference group (see Study design).

Implementation content
Time and place-independent working. Before NWW implementation, employees were expected to be present on weekdays ‘on core hours’ (between 09:30 and 16:00 hrs). They had fixed work desks and departments’ heads had a private room. There was no official policy on working from home. Due to the absence of optimal security systems, it was not encouraged to take documents home or to use one’s private computer.

After implementation of NWW, employees were not bound to certain work times or work locations, unless the work content did pose restrictions in time or location. The organizations’ target was to have 55% of employees working from home (or another remote location) for two days a week. Working from home was officially voluntary, but employees were strongly stimulated to work one or two days from home. They were also expected to work at the office for minimally two days per week. The possibility to work from home was therefore restricted for employees with few (<24) contractual hours. Newcomers were expected to familiarize themselves with work before working from home. When employees performed poorly, working from home could be retracted.

Employees received ergonomic guidelines for designing their home workstation. They signed a checklist with individualized ergonomic requirements, indicating that they agreed to follow these. They received a bureau chair and a budget of up to EUR 600 every five years to ensure ergonomic standards for working at home. They were compensated for extra home costs such as electricity (20 EUR per month when working from home two days a week). By means of questionnaires, working from home was monitored and tested against the organization’s 55% target.

To accommodate place-independent work at the office, the office space was turned into a flexible office where employees no longer had their own work place. The number of available workplaces in the office was adapted according to the 55% home-work target: only sixty workplaces were available for every hundred employees in the NWW office. Managers’ offices were transformed into meeting rooms, and the office area provided more open spaces. For every department, a social meeting space was created. Other rooms were arranged to enable concentration or privacy. Lockers were installed for storing personal belongings. Every floor was equipped with a central service corner, such as a multifunctional. A coffee corner was arranged in all office buildings. Finally, the office was painted anew and got new carpets.

For almost all departments in our intervention group (29 out of 37 departments), the offices were furnished with ‘recycled’ furniture. Six departments received new, ergonomic furniture or a mix, and provided more variability in workplaces. For two departments (n = 146), the NWW status (= new vs. recycled furniture) remained unknown to the researchers. In some cases, office redesign was finished up to six months after the introduction of the other intervention measures.

ICT. Before the intervention, there was little need for ICT to facilitate more flexibility in working time and work location. As part of NWW, all employees received a “personal standard equipment”: a laptop with headset and webcam, and often also a smartphone. Digital ICT applications (e.g. email, chat applications, phone software for
laptops) were installed to enable communication and cooperation from remote locations, and meeting rooms were equipped with smart boards and roundtable camera’s, to enable virtual meetings. Extensive use of intranet was introduced and training was provided in effective use of new facilities.

**Performance-based work and management.**

Before implementation of NWW, employees were expected to work at relatively fixed working times (‘core hours’) and fixed locations. After implementation of NWW, a manager could always ask employees to come to work when this was deemed necessary. Some work thus remained restricted to specific work hours or locations (e.g. employees with customer contacts or cooperating in a project). Performance evaluation now concentrated upon the realization of performance targets. These were agreed upon by supervisor and employee. All employees participated in departmental sessions where these new performance principles were discussed. Employees could participate in courses on taking responsibility, and managers were trained in transferring responsibility to subordinates.

**Study design**

The study had a quasi-experimental longitudinal design (i.e. non-randomized design with intervention and reference conditions). Questionnaires were used to study changes over time within both an intervention group (37 departments) and a reference group where NWW was not implemented (two departments). For this study, three measurements waves were conducted: One pre-measure (one to two months before implementation of NWW) and two post-measures (at, respectively, four and ten months after implementation). Questionnaires used in this study were identical for the three waves. To answer our research questions, we tested whether the organization of work (RQ1) and employees’ outcomes (RQ2) changed over time (from pre to post1 and post2), depending on participants’ condition (i.e. intervention vs. reference condition). As such, we focused on time x group interaction effects on variables related to the organization of work and employee outcomes as indicators of intervention effects (see ‘statistical analysis’).

The implementation of NWW was a complex process: implementation occurred group-wise, over a six-year period (i.e. department by department, between 2008 and 2014). As the timing of NWW implementation differed per department, the measurement moments also varied over departments. For the majority of intervention departments, the timing of questionnaires differed somewhat from the reference group (which was measured in June/July 2012 [pre], January/February 2013 [post1], and September 2013 [post2] – this small shift occurred for practical reasons).

As the researchers had no influence in deciding which departments would participate in NWW or not, randomization of departments in intervention vs. reference groups was not possible. Analyses show that employees from the ‘waiting list’ reference group were somewhat lower educated and reported somewhat less favourable work conditions and well-being on average at baseline (see Tables 2 and 3). Hence, the intervention and reference groups were not fully comparable at the start of the study (see Discussion).

**Sample and procedure**

All employees who participated in the NWW implementation after June 2012 (N = 2,391; 37 departments), along with employees from the reference group (N = 521, two departments), were invited to participate in this study. The study population covers various occupational groups, ranging from sales-persons, financial or IT-specialists, managers and assistants, to administrative personnel and customer service workers. The company provided the researchers with email addresses, and information about contractual hours, age, gender and leadership position. For all three measurement waves, employees received email invitations to fill out the questionnaire, and managers informed all employees about each measurement one week before this invitation was sent. Confidential treatment of data was guaranteed in the invitation. At each wave, the questionnaire was open for three weeks, and a reminder was sent nine days after the initial invitation. Data collection started in June 2012 and ended in December 2014. By then all 37 departments had implemented NWW, and only the employees of the two reference departments did not work according to NWW.
A total of 1,443 employees participated in the pre-measure of this study (39 departments): 1,232 employees within the intervention group (37 departments), and 210 in the reference group (two departments). Response rates per measure (pre-measure, first follow-up and second follow-up measure) and per group (intervention/reference) range from 46% (second post-measure) to 52% (baseline-measure) among the intervention group, and from 37% (second post-measure) to 44% (baseline-measure) for the reference group.

Employees who worked less than three days were not allowed to work from home (see ‘implementation content’). To ensure sufficient exposure to all elements of the NWW intervention, we selected employees who, by contract, worked 24 hours or more per week. A number of employees worked for multiple departments, or changed from department in the course of the study. As the status of such employees with regard to NWW was not clear, these employees were excluded from analyses. Of our sample (intervention group and reference group), 63.9% were male, 10.5% held a leadership position. The mean age was 42.33 years (SD = 10.30), and employees worked on average 35.17 (SD = 4.25) contractual hours per week at baseline. Response to the pre-measure was not biased in terms of gender, age, contractual hours or managerial status.

Only participants who completed the questionnaires of all three measurement waves were included in our analyses. Finally, additional sample attrition occurred due to study drop-out, changes in the workforce (e.g. turnover, reorganizations, transfer to another department, et cetera) or administrative errors. The remaining sample in our analyses covered 361 and 80 participants for the intervention and reference condition, respectively. A complete overview of the sample selection and drop-out is presented in Figure 1.

**Measurement**
Data collection was conducted by means of online questionnaires. In every measurement wave, it was emphasized that all questions pertained to the past four months. Scale reliabilities were assessed by Cronbach’s Alpha and were all satisfactory to high. Reported Cronbach’s Alpha values (α) were calculated at baseline. Reliabilities were highly comparable at all measurement waves.

**Measurements regarding Research Question 1a**
Time-independent work was measured by means of questions on Worktime control (WTC) access, use and satisfaction. WTC access (i.e. employees’ possibilities to self-decide when to work) was measured by questions on access, use and satisfaction. WTC access (i.e. employees’ possibilities to self-decide when to work) was measured by questions on access, use and satisfaction. WTC access (i.e. employees’ possibilities to self-decide when to work) was measured by questions on access, use and satisfaction. WTC access (i.e. employees’ possibilities to self-decide when to work) was measured by questions on access, use and satisfaction. WTC access (i.e. employees’ possibilities to self-decide when to work) was measured by questions on access, use and satisfaction. WTC access (i.e. employees’ possibilities to self-decide when to work) was measured by questions on access, use and satisfaction. WTC access (i.e. employees’ possibilities to self-decide when to work) was measured by questions on access, use and satisfaction. WTC access (i.e. employees’ possibilities to self-decide when to work) was measured by ques

![Figure 1](image-url). Attraction diagram for intervention and reference groups. Note: *Some participants were not invited again due to study drop-out, changes in the workforce (turnover, reorganizations, transfer to different departments, et cetera) or administrative errors.
assessed by seven items, based on Nijp and colleagues (2015), measuring a broad range of specific WTC subdimensions, i.e. whether employees could (i) control daily starting and ending times, (ii) control when to take a break, (iii) control when to take leave (day off or holiday), (iv) control on which days to work, (v) control the distribution of work hours over the week, (vi) control their own working hours, or (vii) work whenever they wanted (based on Nijp et al., 2015). Answers were provided on a 5-point scale (1 = “[almost] not at all” – 5 = “to a very high extent”) and the mean-score of the seven items was used as scale score for WTC-access; \( \alpha = 0.91 \).

A single item assessed whether employees made structural use of such WTC possibilities (i.e. “do you make structural use of the possibility to determine your work times yourself?”; 1 = yes, I do; 2 = no, I don’t; 3 = I don’t have such possibilities). Finally, employees were asked to rate on a 10-point scale their satisfaction with their own say over their work times; 1 = very dissatisfied; 10 = very satisfied).

Place-independent work was measured by means of self-constructed questions on Work location control (WLC) access, use and satisfaction, WLC access (i.e. employees’ possibilities to self-decide where to work) was assessed by two items: “To what extent can you self-decide where you perform your work?” and “To what extent can you self-decide when to work from home?” (mean score of the two items was used as a scale score for WLC-access; \( \alpha = .89 \)).

WLC-use was measured with one item: “Do you make structural use of your possibility to work from home (or some other location than the office)?”, and satisfaction with WLC was measured with the following item: “Indicate how satisfied you are with the degree to which you have say over your work location (home, the office, or elsewhere)”. Response options were similar to WTC measures.

**Work hours.** We asked employees how many hours they worked in total (‘total work hours’), contractually (‘contractual hours’), during the evening (after 18.00hrs; ‘evening hours’), and during the weekend (‘weekend hours’), and how many weekly hours they spent commuting (‘commuting hours’). To identify the hours spent on different work locations, participants were asked how many hours per week they worked at the office (‘office hours’) and at home (‘home hours’). To assess the temporal distribution of working hours at home, employees were asked how many days they worked from home during weekdays (‘weekdays home’), and during the weekend (‘weekend days home’). All work-hour items were self-constructed and pertained to hours per week on average during the past four months.

**Measurements regarding Research question 1b**

We measured job autonomy (4 items; \( \alpha = .87 \)), job demands (3 items; \( \alpha = .87 \)), social contact with colleagues (6 items; \( \alpha = .81 \)) and social contact with supervisors (6 items; \( \alpha = .89 \)). All items were answered on a four-point scale (1 = ‘almost never’, to 4 = ‘almost always’). Most items stem from the QEEW (Van Veldhoven & Meijman, 1994). We added one self-constructed item on cooperation with colleagues from a remote location (i.e. “Are there sufficient possibilities to cooperate with your colleagues remotely?”) to include the use of new ICT means in our measurement, and one item that assessed face-to-face cooperation (“Are there sufficient possibilities to cooperate with your colleagues face-to-face?”). In addition, we asked “Do you have sufficient possibilities to learn from your colleagues?” and “Do you feel connected to your colleagues?” to examine additional aspects of social contact that could be impacted by remote work and flexible work locations at the office.

**Measurements regarding Research Question 2**

**Work–nonwork balance.** We assessed employees’ WHI by means of six items from the SWING (Survey Work-Home Interaction Nijmegen; Geurts et al., 2005). We distinguished between time-based WHI (three items, e.g. “How often does it happen that your work schedule makes it difficult for you to fulfil your domestic obligations?”; \( \alpha = .71 \)) and strain-based WHI (three items, e.g. “How often does it happen that your work obligations make it difficult for you to feel relaxed at home?”; \( \alpha = .82 \)). Answers were provided on a 4-point scale (1 = almost never; 4 = almost always). Higher mean scores on the WHI scales indicate higher levels of interference.

**Health/well-being.** Fatigue was measured with three items from the Fatigue Assessment Scale (De Vries et al., 2004; i.e.: “I am bothered by
fatigue”, “I have enough energy for everyday life”, “Mentally, I feel exhausted”; $\alpha = 0.71$). Answers were provided on a 4-point scale (1 = ‘almost never’ to 4 = ‘almost always’). Participants indicated on ten-point scales to what extent they experienced stress as result from their work (1 = very little stress; 10 = very much stress), and how they experienced their health (1 = very bad; 10 = very good).

**Job-related outcomes: Performance, organizational commitment and job satisfaction.** To measure in-role performance, we used four items from Van Dyne and LePine (1998) (e.g. “I meet my performance expectations”; $\alpha = .89$). Extra-role performance was measured by two items adopted from MacKenzie and colleagues (i.e. “I am always ready to help those around me”; “I take the time to help others at work”; MacKenzie et al., 1991) and one item from Williams and Anderson (1991; i.e. “I take the time to listen to co-workers’ problems and worries”; $\alpha = 88$). Three items adapted from Moideenkutty et al. (2001) were used to measure employees’ affective organizational commitment (e.g. “I feel a strong sense of belonging to my organization”; $\alpha = 0.81$). All items on in-role performance, extra-role performance and commitment were answered on a 7-point response scale (1 = strongly disagree; 7 = strongly agree). Finally, job satisfaction was measured with a single item (“Indicate how satisfied you generally are with your work”; 1 = very dissatisfied; 10 = very satisfied).

**Data Preparation and Statistical Analyses**

When variables were measured by multiple items, scale means were calculated and used in all analyses. For all work hours variables, outlier values (defined as $> 3$ SD above or below the mean; $n = 1–26$, differing per variable) were excluded from analyses.

To test for the effects of the intervention on the continuous outcome variables under study, we conducted repeated measures analyses of covariance (RM-ANCOVA) for each quantitative outcome measure (i.e. all variables, except for WLC/WTC use). Condition served as between-subject variable (two levels: intervention vs. reference), and time served as within-subject variable (three levels: pre-measure vs. follow-up measure 1 [four months after implementation of NWW] vs. follow-up measure 2 [10 months after implementation of NWW]).

Given our research questions, we were mainly interested in time $\times$ group interaction effects (i.e. comparing intervention vs. reference groups regarding their changes in study variables over time). These interaction effects were assessed by Greenhouse–Geisser values for significance. In order to further examine the significance and magnitude of the effects of time, within both groups separately, we inspected post-hoc multivariate effects of time and conducted pair-wise comparisons within both the intervention and the reference group separately on each dependent variable.

The effects on categorical outcome variables (use of WTC, use of WLC), were assessed by means of generalized estimating equations (GEE) analyses. As ‘use of WTC or WLC’ was only relevant to employees with possibilities to use WTC or WLC, respondents who indicated to have no possibilities to use WTC or WLC (i.e. score ‘3’) were excluded from these analyses.

To prevent chance capitalization (due to the large number of dependent variables tested: $n = 27$), we conservatively defined $p < 0.01$ as level of significance, whereas $p < 0.05$ and $> 0.01$ was regarded marginally significant. Effect sizes ($\eta^2$) were interpreted as follows: 0.01–0.059 = small; 0.059–0.138 = medium; and $\geq 0.138$ = large effect (Cohen, 1988).

Gender, age, education (seven ascending levels), contractual hours and job uncertainty (report mark, 1–10) at baseline were included as covariates in all models.

**Results**

**Attrition and selectivity analyses**

First, to assess whether response at baseline was selective, we compared respondents who completed this first questionnaire to those who did not on contractual hours, gender, age and leadership position (using objective data from the organization). This analysis showed no signs of selectivity in the intervention sample (output can be requested from the first author). Among the reference group, employees with fewer contractual hours were less likely to respond to the baseline questionnaire.

Second, to test whether participation in the study after baseline completion was selective, respondents who completed the baseline questionnaire but no
follow-up questionnaire were compared to those who filled out both the baseline and at least one follow-up questionnaire (Table 1). Respondents who filled out follow-up questionnaires were only marginally older, and reported somewhat higher job autonomy (2.75 vs. 2.6). After inspection of effect sizes these differences were considered irrelevant. Accordingly, there is no reason to conclude that response to follow-up questionnaires was selective in terms of sample characteristics or key study variables.

**Intervention effects**

Research question 1a: Effects of NWW on worktime control and work location control, work hours, work location

Results of the analyses on research question 1 are shown in Table 2.

**Control over work times and work location**

No significant interaction effects between condition and time were found on WTC access, WTC use or WTC satisfaction. Although significant increments in WTC access and use were found among the intervention group, similar (but smaller) increments were present in the reference group. Moreover, these effects were all small. Overall, we find no support for an increase in WTC due to implementation of NWW.

Significant interactions between condition and time were found for WLC access, WLC use, and WLC satisfaction. Subsequent analyses show significant, medium and large sized increments in WLC access, WLC use and WLC satisfaction within the intervention group, but no change over time in the reference group. Post-hoc comparisons show a significant increase of WLC-measures after implementation of NWW, but no differences between both post-measures. Hence, the implementation of NWW resulted in increased WLC access, use and satisfaction.

**Work hours and work location**

A significant interaction between group and time indicated changes in total work hours, commuting hours, evening hours, hours worked at the office and hours worked at home (Table 2). Follow-up analyses among the intervention group show significant decrements in commuting hours and hours spent at the office, and increments in hours worked in the evening, hours worked at home, and days worked at home during weekdays. Although employees in the intervention group report somewhat longer weekly work hours after implementation of NWW, this effect was small (an increase from 36.06 to 36.56 hours per week). A small decrease in work hours was noted within the reference group. Also the increase in evening hours among the intervention group was only small (from 0.92 hours at baseline, to 1.13 weekly hours at Post 2). Thus, NWW resulted in a shift of working hours from the office to home during weekdays and in shorter commuting time. Other changes were all rather small. This means that generally speaking, NWW employees work more hours at home, whereas their general working hours pattern remains largely the same, i.e. during weekdays and daytime.

**Table 1. Selectivity analysis.**

| Variable               | Range | M     | SD   | M     | SD   | Sign. (p) | Effect size (Partial $\eta^2$) |
|------------------------|-------|-------|------|-------|------|-----------|-------------------------------|
| Age                    | 42.13 | 9.81  |      | 43.85 | 9.42 | 0.011     | 0.005                          |
| Gender male (%)        | 66.1% | /     |      | 61.0% | /    |           |                               |
| Education              | 1–7   | 4.78  | 1.68 | 4.86  | 1.66 | 0.533     | 0.000                          |
| WTC_M                  | 1–5   | 3.10  | 0.91 | 3.09  | 0.87 | 0.848     | 0.000                          |
| WLC_M                  | 1–5   | 2.69  | 1.11 | 2.59  | 1.16 | 0.248     | 0.001                          |
| Job demands            | 1–4   | 2.43  | 0.66 | 2.43  | 0.67 | 0.974     | 0.000                          |
| Job autonomy           | 1–4   | 2.60  | 0.67 | 2.75  | 0.66 | 0.001     | 0.009                          |
| Support Colleagues     | 1–4   | 3.10  | 0.51 | 3.06  | 0.54 | 0.264     | 0.001                          |
| Stress                 | 1–10  | 4.84  | 1.96 | 4.82  | 2.02 | 0.902     | 0.000                          |
| Health                 | 1–10  | 7.33  | 1.30 | 7.34  | 1.28 | 0.925     | 0.000                          |
| Job satisfaction       | 1–10  | 7.39  | 1.06 | 7.34  | 1.00 | 0.471     | 0.001                          |
| Job insecurity         | 1–10  | 4.75  | 2.42 | 4.90  | 2.52 | 0.383     | 0.001                          |

Note. Data derived from pre-measure. *Tested by chi-square analysis. All else: univariate analysis of variance. Response samples vary due to missing data.
Table 2. Effects of NWW on the organization of work: WTC and WLC, work hours and work location.

| Variable          | Range | Intervention group (n = 281–359) | Reference group (n = 66–79) | Intervention effect |
|-------------------|-------|-----------------------------------|----------------------------|---------------------|
|                   |       | Means | Effect time | Means | Effect time | (Group*time) |
|                   |       | Baseline | Post 1 | Post 2 | p | η² | Baseline | Post 1 | Post 2 | p | η² |
| WTC/WLC           |       |       |           |       |       |       |           |       |       |       |
| WTC access        | 1–5   | 3.14²  | 3.23²  | 3.33¹  | 0.000 | 0.042 | 3.12²  | 3.14²  | 3.18²  | 0.647 | 0.002 | 0.509 | 0.003 |
| WTC use           | % use | 57.9%² | 68.5%² | 74.9%¹ | 0.000 | 0.073 | 62.5%² | 64.9%² | 76.0%² | 0.017 | 0.024 | 0.734 | -    |
| WTC satisfaction  | 1–10  | 7.60²  | 7.75²  | 7.73¹  | 0.143 | 0.009 | 7.69²  | 7.51²  | 7.83¹  | 0.095 | 0.011 | 0.079 | 0.006 |
| WLC access        | 1–5   | 2.69²  | 3.03¹  | 3.11²  | 0.000 | 0.131 | 2.48²  | 2.51²  | 2.42²  | 0.531 | 0.003 | 0.000 | 0.024 |
| WLC use           | % use | 53.4%² | 89.2%² | 90.9%¹ | 0.000 | 0.355 | 51.7%² | 46.2%² | 50.0%² | 0.948 | 0.000 | 0.000 | 0.009 |
| WLC satisfaction  | 1–10  | 6.55²  | 7.20¹  | 7.27¹  | 0.000 | 0.087 | 6.32²  | 6.41²  | 6.41²  | 0.974 | 0.000 | 0.009 | 0.012 |
| Work hours/location|     |       |           |       |       |       |           |       |       |       |
| Work hours        | Hours/week | 36.06² | 36.56² | 36.54³ | 0.034 | 0.016 | 36.35² | 35.36³ | 35.54³ | 0.060 | 0.013 | 0.004 | 0.013 |
| Commute hours     | Hours/week | 5.79²  | 4.74²  | 4.84³  | 0.000 | 0.123 | 5.15²  | 5.28²  | 5.47³  | 0.711 | 0.002 | 0.004 | 0.015 |
| Evening hours     | Hours/week | 0.92²  | 1.35²  | 1.13³  | 0.000 | 0.086 | 1.00²  | 0.95²  | 0.98³  | 0.982 | 0.001 | 0.012 | 0.011 |
| Weekend hours     | Hours/week | 0.51²  | 0.59²  | 0.59³  | 0.089 | 0.012 | 0.41²  | 0.43²  | 0.51³  | 0.868 | 0.001 | 0.838 | 0.000 |
| Office hours      | Hours/week | 30.70² | 23.07² | 22.48³ | 0.000 | 0.542 | 31.06² | 30.75³ | 30.72³ | 0.966 | 0.000 | 0.000 | 0.125 |
| Home hours        | Hours/week | 4.55²  | 12.54² | 12.97³ | 0.000 | 0.615 | 5.70²  | 5.92²  | 6.29²  | 0.971 | 0.000 | 0.000 | 0.152 |
| Home days/week    | Days/week | 0.65²  | 1.51²  | 1.64³  | 0.000 | 0.401 | 0.69²  | 0.83²  | 0.79³  | 0.572 | 0.003 | 0.000 | 0.056 |
| Home days/weekend | Days/weekend | 0.11²  | 0.13³  | 0.15³  | 0.171 | 0.011 | 0.12²  | 0.10³  | 0.14³  | 0.539 | 0.004 | 0.806 | 0.001 |

Note. Work hour data are trimmed values; * = significantly differs from baseline measure; ° = significantly differs from post-measure 1; ¹ = significantly differs from post-measure 2; ² = no significant differences from baseline measure; ³ = no possibility for use due to covariates. WTC = Worktime control; WLC = Work location control. Within group time effects: multivariate effect of time on estimated marginal means. Age, gender, education, contractual hours and job insecurity at baseline included as covariates. WTC = Worktime control; WLC = Work location control. Wald chi-square value [WTC use] = 116; Wald chi-square value [WLC use] = 31.298. Sample size differs due to exclusion for WTC use or WLC use (if response was ‘no possibility for use’), or due to exclusion of outliers for work hour variables.

Research question 1b: Effects of NWW on psychosocial job characteristics

We found significant interactions between condition and time on job demands. Analyses revealed a decrease in job demands in the reference group. No effects of time were found within the intervention group, suggesting that NWW did not impact job demands. As no significant time x group interactions were found for job autonomy and support from colleagues and supervisors, we conclude that NWW did not change the major psychosocial work characteristics, and these remained favourable.

Research question 2: Effects on employees’ outcomes

Results of the analyses on research question 2 (employees’ outcomes) are shown in Table 3.

Work–nonwork balance

Analyses revealed no significant interaction between time and condition on WHI, so the implementation of NWW did not influence WHI.

Health/well-being

A significant interaction between time and condition was found for health (small effect size). Further inspection reveals a medium-sized decrease in self-reported health (from 7.47 to 7.04) in the intervention group, and no change in the reference group. No consistent pattern was found for stress (no significant effect) or fatigue (only a marginal short-term decrease in fatigue from 1.76 to 1.71 from pre to post 1). Hence, the introduction of NWW was accompanied with a medium sized decrease in health, but no noteworthy change in the two other indicators of health and well-being.

Job-related outcomes

Small, significant interactions between condition and time were found for organizational commitment, organization perception, and performance. However, these interactions are due to changes in the reference group. No significant changes were found within the intervention group. Hence, the implementation of NWW did not impact employees’ job-related outcomes.
Comparing short-term and midterm effects

Inspection of post-hoc tests (Tables 2 and 3) show that effects from baseline to the first post-measurement (i.e. short-term effects) are largely comparable to those from baseline to the second post-measurement (i.e. the mid-term effects). Thus, the effects of NWW seem consistent over time.

Discussion

NWW is a type of work organization that is characterized by time- and place-independent work, often combined with extensive use of ICT and performance based management. In a three-wave intervention study, we examined the effects of NWW on temporal and spatial aspects of work organization, on other key psychosocial factors, and on employees’ outcomes: work–nonwork balance, health and well-being, and job-related outcomes.

Regarding the organization of work, the implementation of NWW resulted in increased access to, use of and satisfaction with work location control. NWW employees reported more working hours at home and accordingly less office hours and commuting time. Their general working hours pattern remained largely the same: work was still mainly executed during weekdays and daytime. Moreover, NWW did not seem to affect worktime control nor key elements of the psychosocial work environment (demands, control, support/contact). The effects of NWW on employees’ outcomes are limited. Our analyses show no changes in WHI, suggesting that NWW did not improve nor hinder employees’ work–nonwork balance. Despite further null effects on fatigue or stress, a decrease in health was found after the implementation of NWW. No changes were found in employees’ performance, organizational commitment or job satisfaction.

Some of these main results deserve further discussion. First, the absence of an increase in worktime control due to NWW and the stable weekly work hours pattern are notable, as temporal flexibility is regarded one of the core aspects of NWW. Before NWW-implementation employees already were generally satisfied with their work time control (7.60 on a 1–10 scale) and reported only little variability and high regularity in work hours (i.e. mostly daywork, few working hours during the evening or weekend, and their working times seemed to meet their preferences). This means that there was not that much room for improvement regarding regularity of working hours or working according to preferred working times. It is plausible that the majority of employees in this study simply prefer to work on weekdays and during daytime. Including measurements of employees’ chronotype or social commitments (e.g. children or care for other family members) in future NWW studies could shed more light on such working hours preferences.

Second, the increase in work from home and the accompanying decrease in office days were to be expected because employees were strongly
encouraged to work one or two days a week at home, and office space was reduced accordingly. However, work from home did not seem to be interpreted as merely mandatory or involuntary, because satisfaction with work location control increased significantly after NWW implementation. This does imply that, generally speaking, work from home in this NWW organization can be regarded as a combination of both organization-based and employee-based flexibility.

Third, the stable quality of the psychosocial work environment may be at least partly explained by the fact that employees’ job content, i.e. work itself, remained the same. Social support did not change either. This suggests that employees, despite the marked increase in work from home, kept in touch with their colleagues and supervisors. The minimum requirement for full-timers of ‘two office days presence a week’ may have been helpful in maintaining social cohesion. As such, for full-time employees ‘a 50/50-rule’ regarding work location (i.e. to be at least 50% of working time at the office) could be advisable to maintain good quality of social and functional relations between employees.

Fourth, despite the increase in work from home, we found no change in WHI. Work from home did not hinder, but also did not improve employees’ balance between work and the nonwork domain. As WHI was already low at baseline (average of 1.45, on 1–4 scale), this stability may reflect a ‘floor effect’; obviously there was little room for improvement in this sample. The absence of effects on indicators of well-being (fatigue and stress) and performance can be interpreted in a similar vein. Future studies among samples with less favourable baseline work–home balance-, well-being-, and performance scores may show whether NWW practices have limited effects on such indicators or that effects will be present when there is more room for improvement.

Finally, self-reported health was the only employee outcome that consistently changed after implementation of NWW. However, the decrease in health should be interpreted with caution, as indicators that usually underlie, precede or accompany health complaints did not change (stress), or rather showed some possible minor improvement (fatigue – small short-term effect only). Also potential causal factors such as job demands remained moderate and unchanged. Nevertheless, we recommend this company to further monitor employees’ health status.

**Assets and limitations**

An increasing number of organizations have implemented NWW, or is in the process of doing so (Blok 2012; Ouye et al., 2012; Van der Meulen, 2014). This large-scale intervention study is among the first to examine the effects of a NWW implementation in a real-life work setting and by means of a thorough intervention design. The study was complex as the implementation of NWW occurred in phases (‘department-after-department’), implying that each of the 39 departments had its own ‘implementation-timeline’ and accordingly its own measurement timeline. As a result, it took 2.5 intensive years to collect all data. The study contains an intervention group as well as a reference group and includes longitudinal within-person data from three waves (one pre and two post-measurements), which allows for examination of short and longer term effects of NWW. We believe that another strong point is the measurement of a rich set of theoretically relevant proximal and distal variables (Semmer, 2011). This enables a comprehensive insight in effects on both work and the worker. We assessed these variables with valid measures, and placed special emphasis on the two central NWW aspects: employees’ control over work time and over work location. Following the advice of Niij et al. (2015), we made a fine grained distinction between access to-, use of-, and satisfaction with- worktime control and work location control.

Yet, there are several limitations to this study. First, the applied intervention design is not without problems. We were not able to self-select intervention and reference groups (no randomization), but applying a textbook randomized controlled trial is often not feasible in real-life organizations. One of the reasons is that researchers are ‘guests and not autocrats’ (Griffiths, 1999; see also Kompier & Kristensen, 2001). Although with Kristensen (2005) we do agree that ‘a reference group is better than no reference group’, our reference group poses problems. First, the intervention group and the reference group differed somewhat on a number of baseline study variables. Second, due to the number of measurement waves and additional
naturally occurring drop-out (e.g. due to job changes), there was substantial attrition within the reference group. Thus, the comparison of both groups is imperfect. We have dealt with this problem by combining three perspectives when interpreting the study results: (i) the group x time interactions; (ii) the time effects in the intervention group; and (iii) the prevalence scores, for example baseline levels of the studied variables. With respect to attrition that logically occurs in long time longitudinal studies, we have conducted checks for selection bias. Our selectivity analyses show that within our NWW group the response to questionnaires was not biased in terms of key study variables (at baseline nor at follow-up measurements). As such, it seems safe to conclude that our intervention group constitutes a valid representation of the total intervention study population.

**Theoretical implications**

When it comes to predicting the potential effects of NWW both ‘sunny’ and ‘gloomy’ perspectives prevail. On a more theoretical note it is important to not conceive of NWW as a unidimensional phenomenon, nor a simple ‘pill’. NWW comes in many qualities, which means that the exact content of NWW may vary importantly among organizations. It also comes in many quantities. This means that the actual (degree of) implementation may vary as well. For example, work from home can be either mandatory or voluntary. It may take place on a kitchen chair or on an ergonomic work station, with or without appropriate ICT and performance management. In some NWW-organization employees may work the majority of their working time from home, in others work from home may be limited to one day a week. Flexible workplaces at the office may be ample (for example 90 work stations for 100 employees) or strict (40 workstations for 100 employees). These work stations may be noisy or enable concentration work, et cetera. Apart from the exact nature (quality and quantity), also the introduction and implementation do matter (Baane et al., 2011; Kompier & Kristensen, 2001; Nielsen & Randall, 2013). In the light of such content-wise, contextual and process considerations, this study’s findings cannot simply be generalized to other NWW interventions and other companies.

It is important to conduct and investigate additional natural experiments of NWW to learn more about effects and effect modifiers.

**Implications for practice**

We found no evidence for a ‘sunny’, nor for a ‘gloomy’ perspective on NWW. Changes in psychosocial job characteristics were absent, nor were there (un)favourable implications for employees in terms of work–home balance, well-being or performance. As the current study covers one specific organization that implemented one specific form of NWW (among a sample with already favourable work characteristics and favourable outcome measures before implementation of NWW), additional natural experiments are required to enable solid conclusions as to which NWW manifestations, under which circumstances, may have which kind of consequences. For now, there is no reason to explicitly encourage or discourage the practical implementation of NWW. We conclude that implementation of NWW does not necessarily lead to changes in psychosocial job characteristics, and that it is possible to implement such a large and far-reaching intervention without negatively affecting employees’ work–nonwork balance, well-being or job-related outcomes.

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