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Work–home interference: How does it manifest itself from day to day?

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Abstract

Although work–home interference (WHI) refers to a process of negative interaction between the work and home domains, little attention has been paid to the actual processes involved in the within-person, day-to-day management of work and home. Therefore, this study investigated if, and how, a global report, for the individual, of WHI (i.e., a general indicator of experienced WHI) is reflected in daily reports of WHI, in employees’ daily activity patterns in the work and home domain, and in their daily health and well-being. Effort-Recovery theory (Meijman & Mulder, 1998) provided the theoretical basis for this study. Data were collected among 120 academic staff members (62% male) who completed a general questionnaire, addressing global WHI as well as demographical information, and who also participated in a 5-day daily diary study. WHI was measured using the 8-item WHI subscale of the Survey Work–home Interaction Nijmegen (SWING), with an adapted version being used for the diary studies. Results showed that global WHI: (1) was positively related to daily WHI; (2) was positively related to the time spent daily on overtime work in the evening; (3) was negatively related to the time spent daily on low-effort activities; and (4) was positively related to daily fatigue and sleep complaints. We conclude that Effort-Recovery theory seems promising for the study of WHI, and that diary studies are valuable, as these provide detailed insight into what global reports of WHI actually signify from day to day.

Keywords: Work–family conflict, work–family interference, diary studies, work-related stress, recovery, SWING

Introduction

Successfully combining work and nonwork is a major issue for many employees, and sometimes creates serious problems or conflicts between the two domains. Empirical research (Geurts, Taris, Kompier, Dikkers, Van Hooff, & Kinunnen, 2005; Kinnunen & Mauno, 1998; Leiter & Durup, 1996; among others) has consistently shown that work demands negatively affect private life (i.e., create work–home interference; WHI) more often than the other way around (i.e., home–work interference). In the light of the reported higher prevalence of WHI, the current study focuses exclusively on this type of interference and specifically on its relationships with employees’ well-being and their activity patterns in the work and home domains.

WHI has been defined as “a form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible so that participation in one role...
WHI may occur in three distinct ways (Greenhaus & Beutell, 1985). It may arise from time demands that make it physically impossible to be in two places at the same time (e.g., when long hours in paid work prevent participation in family activities); from the spillover of strain from one domain to the other (e.g., when strain built up at work makes it more difficult to feel relaxed in the home environment); or when specific behaviours that are expected at work are incompatible with behaviours that are expected at home (e.g., teachers may continue to act as teachers in their relationships with their own children or spouse). As previous research demonstrated that particularly the first two types of conflict are related to health-related outcomes and work- and family-related antecedents (see, for instance, the meta-analyses by Allen, Herst, Bruck, & Sutton, 2000; Eby, Casper, Lockwood, Bordeaux, & Brinley, 2005), the present study focused on these two types of conflict.

Although WHI refers to a process of negative interaction between the work and home domains (Geurts & Demerouti, 2003), remarkably little attention has been paid to the actual processes involved in the within-person, day-to-day management of work and home demands. WHI is typically measured on single occasions, retrospectively, at times detached from the occurrence of specific activities and experiences, and in terms of the “average” level of interference. Moreover, insofar as longitudinal designs are employed, they cover relatively long time lags, varying from 6 weeks (Demerouti, Bakker, & Bulters, 2004) to 4 years (Frone, Russell, & Cooper, 1997). Such intermediate to long-term longitudinal studies are largely irrelevant for mapping the specific shorter-term processes underlying the global experience, for the individual, of WHI (i.e., a general indicator of experienced WHI). To understand WHI more fully, it is vitally important to identify the specific day-to-day activities and experiences and processes associated with the experience of (global) WHI and its consequences for worker health and well-being.

To date, four studies have examined WHI from such a day-to-day perspective. Williams and Alliger (1994) showed that working parents reported higher daily levels of WHI on days on which they were highly involved with their jobs. In addition, Butler, Grzywacz, Bass, and Linney (2005) concluded that higher levels of daily WHI were associated with higher daily levels of job demands and lower levels of job control. Further, MacEwen and Barling (1994) found that daily WHI was related to daily psychological strain, which in turn was related to marital behaviour (withdrawal and anger). Finally, Grzywacz, Almeida, and McDonald (2002) related a global measure of negative work–family spillover to daily reports of work–family stress (i.e., the co-occurrence of work- and family-related stressors on the same day) and reported a significant (although modest) association between the two.

The present study

The present study aimed at investigating to what extent and how global WHI manifests itself in everyday life. To this aim, we conducted a diary study covering five consecutive weekdays, preceded by a questionnaire tapping several general and background constructs. This diary approach is very convenient for mapping the everyday activities, behaviours, and feelings of the participants, although this approach has several drawbacks as well. (The most notable of these is the fact that only a limited number of issues can be addressed daily, to keep the burden placed on the participants within acceptable limits, Bolger, Davis, & Rafaeli, 2003.) The present study specifically focused on the associations between global
WHI and: (1) daily reports of WHI; (2) time spent daily on (effortful) work-related activities; (3) time spent daily on home activities; and (4) daily reported recovery indicators.

**Theoretical framework.** Effort-Recovery theory (Meijman & Mulder, 1998) provided the theoretical basis for our study, describing how day-to-day effort expenditure and recovery processes relate to health and well-being. One central assumption in Effort-Recovery theory is that time demands and work-related strain (two core components of WHI) will have detrimental health effects when opportunities for recovery between successive periods of effort expenditure are insufficient. Recovery may be insufficient in terms of quantity (recovery time is too short due to, for example, long working hours) or quality (workers’ preoccupation with work and sustained activation prevents them to relax during nonwork time; Ursin, 1980). Day-to-day incomplete recovery will eventually initiate a cumulative process that, in the long run, may seriously affect health (e.g., result in prolonged fatigue, sleep deprivation, and other health problems; see, for example, Sluiter, Frings-Dresen, Van der Beek, & Meijman, 2001; Taris, Beckers, Verhoeven, Geurts, Kompier, & Van der Linden, 2006).

Employees’ behaviour and activities in the work and nonwork domains play an important role in Effort-Recovery theory. It is the effort invested in work activities that relates to the subjective need to recover from work. Similarly, activities in the nonwork domain (e.g., working overtime) may interfere with the recovery process. This is in line with other work-psychological approaches such as action theory (Frese & Zapf, 1994; Taris & Kompier, 2005) and the demand-control model (Karasek & Theorell, 1990), which implicitly or explicitly assume that work characteristics (such as work load and autonomy) affect worker well-being (e.g., fatigue or positive mood) through worker behaviour: it is what people do that makes them feel tired or enthusiastic. This reasoning underscores the necessity to map day-to-day activities and experiences to understand the WHI phenomenon in more detail.

**Research questions.** Based on this theoretical perspective, four research questions were addressed:

(1) **How do global reports of WHI correspond with daily reports of WHI?**

As we expect a global report of WHI to reflect an aggregate of day-to-day experiences, we assume the global and daily measures of WHI to be positively related. Previous research has failed to address this issue, perhaps because this association seems quite obvious. Yet, it is important to establish the validity of the commonly-used global indexes of WHI by examining the extent to which the scores on this global measure relate to daily experiences. This gives us our first hypothesis.

_Hypothesis 1:_ Global reports and daily measures of WHI are positively related.

(2) **How do global reports of WHI relate to time spent daily on (effortful) work activities?**

The amount of time occupied by the job is one of the most obvious ways for work to affect private life. The time devoted to work activities may interfere with the time available for home activities, and long working hours may impose such demands on employees’ resources that they may lack the energy to engage in certain home activities. Empirical research has indeed shown that long weekly working hours (i.e., long regular work time or overtime hours) are associated with higher levels of WHI (Geurts & Demerouti, 2003, for a
An 8-month cohort study revealed that long regular working time, overtime hours, and commuting time to work were longitudinally related to higher levels of WHI (Jansen, Kant, Nijhuis, Swaen, & Kristensen, 2004). However, as yet, only global measures of work-related time spent have been related to WHI. By using such global measures, both the type of work activities and variations in hours spent on these activities across days are ignored. Two exceptions are the diary studies conducted by Sonnentag (2001) and Rau and Triemer (2004), revealing negative associations between overtime hours and individuals’ well-being before going to sleep.

When examining work time in relation to WHI, not only the hours spent on work activities are important, but also the extent to which the workday was considered effortful. According to Effort-Recovery theory (Meijman & Mulder, 1998), it is the expenditure of effort during work time that may result in the spillover of load effects to the home domain and, thus, to functioning in this domain. Assessing effort expenditure is somewhat less relevant in case of overtime work because this again activates the psychobiological systems that were already turned on during regular work time. In this sense, working overtime is likely to interfere with the recovery process, irrespective of the amount of effort it requires. This results in our next hypothesis.

**Hypothesis 2:** Global WHI is positively related to (1) (effortful) work activities by day (**Hypothesis 2a**), and (2) overtime hours in the evening (**Hypothesis 2b**).

### (3) How do global reports of WHI relate to time spent daily on home activities?

Although occupational health psychologists traditionally focus on the work domain in relation to WHI and health, the home domain deserves the same amount of attention (Geurts & Demerouti, 2003). Activities in the latter domain may be divided into three categories: (1) domestic activities (such as doing household chores); (2) active leisure activities (such as exercising and visiting friends); and (3) low-effort activities (such as watching TV or reading a novel). The time available for home activities will obviously be limited by the time spent on work activities. Strain developed at work may also prevent employees from engaging in certain nonwork activities (e.g., after a stressful workday employees do not feel like exercising). As WHI may originate from the experience that private time is insufficient for doing the things people must or want to do at home, or from the spill over of strain built up at work, this gives us our third hypothesis.

**Hypothesis 3:** Global WHI manifests itself as less time spent on domestic activities (**Hypothesis 3a**), active leisure activities (**Hypothesis 3b**), and low-effort activities (**Hypothesis 3c**).

### (4) How do global reports of WHI relate to daily reported recovery indicators?

Theoretically, WHI implies a lack of quantitative (due to lack of time) or qualitative (due to spillover of strain) opportunities for recovery. Previous research supported the assumption that global WHI is positively related to measures indicating such a lack of recovery, such as fatigue (Van Hooff et al., 2005) and sleep complaints (Geurts, Rutte, & Peeters, 1999). From an Effort-Recovery perspective it can also be assumed that global WHI will manifest itself in day-to-day incomplete recovery. Therefore, we formulate our next hypothesis.

**Hypothesis 4:** Global WHI is positively related to sleep complaints (**Hypothesis 4a**) and fatigue (**Hypothesis 4b**) on a day-to-day basis.
A recent 1-year two-wave study among Dutch police officers revealed that health was impaired across time among workers experiencing chronically high WHI (Van Hooff et al., 2005). The authors suggested that the persistence of a relatively high level of WHI (and related lack of recovery) accounted for an accumulation of health complaints. Similarly, in the current study we expect that a high level of global WHI manifests itself in an increasing lack of recovery, i.e., increment of sleep complaints and fatigue. This results in our final hypothesis.

**Hypothesis 4c:** There will be an increase in sleep complaints and fatigue over the working week for those experiencing high levels of global WHI, relative to others.

**Method**

*Participants and procedure*

The study was conducted among academic staff members of a Dutch university. In order to be eligible, they had to meet three criteria: (1) they should have substantial work obligations (i.e., they should work at least 3 days a week); (2) they should not have a job outside that university (in order to keep the variation in work activities within acceptable limits); and (3) they should live together with a partner who worked at least 2.5 days a week. This last criterion was added to increase the likelihood that the participants fulfilled at least some home obligations.

The study was conducted in three stages. First, all faculty members (N = 696) who met the first criterion received a letter explaining the goal, content, and time schedule of the study, clarifying that only those who passed the second and third criteria could participate. A total of 146 employees agreed to participate. Secondly, these participants completed a general questionnaire that was sent to them by mail and that addressed background information as well as a global report of WHI. During the third stage (about 10 days after filling out the general questionnaire), participants completed paper and pencil diaries during five consecutive weekdays (Monday to Friday), addressing daily WHI, work-related activities and home activities, and recovery indicators. Before the start of this third stage, the researchers met face-to-face with each participant (except in a few cases when it was not possible) to hand over the diaries and to once more explain the study’s procedure.

Each day, the respondents completed three short questionnaires incorporated in a small booklet: (1) a morning questionnaire (to be completed after waking up, preferably between 7.30 and 8.30 am); (2) an afternoon questionnaire (to be completed preferably around 6 pm); and (3) an evening questionnaire (to be completed before going to bed, preferably between 10 and 11 pm). Participants were requested to return each booklet the day after it had to be completed (which was either by internal university or by standard mail, using prepaid envelopes). By having the participants indicate the exact time at which they filled out each questionnaire, we gained information about possible differences between the preferred and actual moment of completion.

Of the 146 employees who agreed to participate, 133 completed the general questionnaire (91% response). Data from 13 of these 133 were removed as they apparently did not meet the second and third criterion. The final sample comprised 120 participants (62% male; 68% had at least one child living in the household; M_age = 45 years, SD = 7.8; they worked on average 34 [SD = 5.5] contractual hours weekly; 46% worked as an assistant professor, 17% as an associate professor, 11% as a full professor, and the remaining 26% had jobs such as researcher or lecturer). Due to strict privacy regulations, we could not obtain more information with respect to the approached 696 academics, except for their
gender. Therefore, we do not know how many of those employees were actually eligible for participation in the study, meaning that the overall response rate and the representativeness of our sample are unknown. However, compared to the number of academics who were approached, women were over-represented in our sample ($\chi^2 = 17.06, df = 1, p < .01$).

With respect to the daily diaries, the response rate ranged from 82% to 86%. Diaries were discarded if they were (1) not filled in at all, (2) completed without any time specification, or (3) completed at a time that deviated substantially from the requested time range (e.g., if afternoon questionnaires were filled in before 4.30 pm, after 8 pm, or less than 3 hours after the morning questionnaire). The percentages of valid diaries was 71% in the morning, 72% in the afternoon, and 76% in the evening.

Measures derived from the general questionnaire

Global Work–home interference (WHI) was measured with the 8-item WHI subscale of the SWING (Survey Work–home Interaction Nijmegen; Geurts et al., 2005). Previous research has established the validity of this instrument, showing that its factor structure is invariant across different samples and subgroups (i.e., according to gender, parental status, and work hours), and that the dimensions of the SWING retain meaningful relationships with external (theoretically relevant) variables. The SWING was developed in such a way that items were preferably not confounded with possible antecedents (e.g., social support) or consequences (e.g., fatigue) of WHI (Geurts et al., 2005). Two examples of items are “How often does it happen that your work takes up time that you would have liked to spend with your spouse/family/friends?” and “How often does it happen that you find it difficult to fulfill your domestic obligations because you are constantly thinking about your work?” All items are scored on a 4-point scale [0 = “(almost) never,” 1 = “sometimes,” 2 = “often,” 3 = “(almost) always”] and higher scores reflect higher levels of WHI ($\alpha = .73, M = 1.02, SD = 0.42$ in the present sample). This mean score is higher than the mean score found in a heterogeneous reference group ($M = 0.86, SD = 0.48, T(1975) = 3.56$; Geurts et al., 2005), indicating that the present sample experienced relatively high levels of global WHI.

Demographic variables. Parental status (0 = “no children living in the household” and 1 = “at least one child living in the household”), gender (0 = “male” and 1 = “female”), age (in years), and contractual work hours (number of hours) were included to reduce the risk of finding spurious associations between global WHI and the daily measures, due to their possible common variation with both.

Measures derived from the daily questionnaires

Daily Work–home interference (WHI) was measured by asking participants to report in the diaries every evening to what extent their work demands had interfered that day with their home life. For this purpose, we adapted Geurts et al.’s (2005) 8-item global measure of WHI to fit the daily questionnaires, both in terms of item wording and response options. Two examples of items were “Today, I had to cancel or reschedule appointments with my spouse/family/friends due to work-related commitments” and “Today, I found it difficult to fulfill my domestic obligations because I was constantly thinking about my work” (1 = “no,” 2 = “a little,” and 3 = “yes”). This version of the WHI-subscale of the SWING was especially developed for the present study, meaning that research into the validity of this scale is as yet not available. However, as the items are strongly based on those of the global
WHI scale, there seems little reason to question the face validity of the items. Further, the reliability of our instrument was quite acceptable, $\alpha = .82$ across all five consecutive days.

**Time spent on work-related activities.** Following a job description approach, participants were given a list of 13 possible work activities, i.e., “preparing a lecture,” “giving a lecture,” “reading (Ph.D.) students’ assignments,” “appointments with (Ph.D.) students,” “conducting research,” “data-analysis,” “reading specialist literature,” “writing papers,” “preparing a meeting,” “attending a meeting,” “e-mail/phone,” “informal contact with colleagues,” or “other.” This list of work activities resulted from interviews that had been held previously with 10 male and female faculty members within “an average” department, who reported the most relevant activities of a typical working day (these faculty members did not participate in the main study). Note that all these work activities are in principle relevant to all participants, i.e. in The Netherlands lecturers also have some research time, whereas researchers will usually also have some teaching duties. For each activity, participants indicated the amount of time they had devoted to it during regular work time, i.e., until 6 pm (afternoon questionnaire), as well as during nonwork time, i.e., from 6 pm onwards (evening questionnaire). In order to simplify completion of the diaries, participants could check a number indicating a time range (0, 1 = < 1 hour, 2 = 1–2 hours, ..., 6 = 5–6 hours, and 7 = > 6 hours) rather than the actual time spent. We recoded these responses to obtain an estimate of the actual time in hours, by assuming that the actual time spent on an activity would be in the middle of the two extremes associated with each answer category (e.g., the category “< 1 hour” was recoded as “0.5” and the category 2 as “1.5”). The validity of our list of activities was supported by the fact that the time spent on “other” activities ranged from only 0.38 hours (Friday) to 0.55 hours (Thursday).

**Time spent on work activities by day** (i.e., in regular work time) was computed by summing the time spent on all 13 work activities until 6 pm. **Time spent on effortful work activities by day** was computed by adding up the time spent on the most effortful work activities until 6 pm. To determine which activities were generally considered most effortful, for each activity we averaged respondents’ evaluations of how much effort this activity had required: 1 = “no effort at all” to 10 = “extremely effortful”. Three activities received average group ratings of 5 and higher (i.e., “giving a lecture” with 6.6, “conducting research” with 5.2 and “writing papers” with 5.1), and were, therefore, considered as most effortful. **Overtime (evening)** was computed by summing the time spent on all 13 work activities after 6 pm (the university did not teach evening courses).

**Time spent on home activities.** Home activities included domestic activities, active leisure, and low-effort activities. Participants indicated in both the afternoon (until 6 pm) and evening questionnaires (from 6 pm) the amount of time they had spent that day on each of 10 home activities, that is, “household activities,” “doing odd jobs in or around the house,” “doing the groceries,” “care giving activities,” “businesslike private-activities,” “physical activities,” “creative activities,” “social activities,” “low effort activities,” and “other” (Sonnentag, 2001). To ease interpretation of the categories, we supplied the participants with examples of activities falling in each category. Answer categories and coding procedure were identical to those used for the work activities. Again, the validity of our activities list was supported by the fact that the time spent on “other” activities ranged from only 0.11 hours (Friday) to 0.38 hours (Thursday). The **Time spent on domestic activities** was estimated by summing the total time (i.e., before and after 6 pm) devoted each day to the first five of the home activities listed
above. **Time spent on active leisure activities** comprised the total time spent daily on “physical activities,” “creative activities,” and “social activities.” To compute the total time spent daily on “low-effort activities,” the time devoted to these activities before and after 6 pm was summed.

**Recovery indicators.** To assess **sleep complaints**, a sum score was computed of five items adapted from a sleep quality scale derived from the Questionnaire on the Experience and Evaluation of Work (VBBA; Van Veldhoven & Broersen, 1999; Van Veldhoven & Meijman, 1994). This instrument has been widely used in scholarly research (e.g., Van Veldhoven, De Jonge, Broersen, Kompier, & Meijman, 2002). As these items were originally developed to measure chronic sleep complaints, some of them were slightly adapted to make them suitable for day-to-day measurement. Two examples of items were “I slept well last night” (reversed) and “Last night, I woke up several times” (1 = “yes,” 0 = “no,” \( \alpha = .73 \) across all five consecutive days). Note that for sleep complaints each day’s value refers to the previous night.

**Fatigue** was measured in the evening questionnaire with the 6-item fatigue subscale of a short version of the Dutch Profile of Mood States questionnaire (POMS; Wald & Mellenbergh, 1990). The POMS (McNair, Lorr, & Droppelman, 1992) has been used in some 3,000 scholarly publications since its development (McNair, Heuchert, & Shilony, 2003), and its validity has firmly been established (e.g., Boyle, 1987; Jacobson, Weiss, & Steinbook, 1978; Norcoss, Guadagnoli, & Prochaska, 1984; Reddon, Marceau, & Holden, 1985).

Based on factor- and item-analyses, a short version of the Dutch translation of the POMS was developed (Wald & Mellenbergh, 1990), in which the fatigue subscale comprised six items. In a previous study examining the factor-structure of the 65-item version of the POMS, these six items showed the highest factor loadings on the fatigue factor (Norcoss et al., 1984). Wicherts and Vorst (2004) found support for the factor structure of the shortened Dutch POMS in a sample of 5,880 psychology freshmen and reported measurement invariance across gender for the fatigue-subscale as well.

Items were scored on a 5-point scale (1 = “not at all,” 2 = “a little,” 3 = “moderately,” 4 = “quite a bit,” 5 = “extremely”), and the scale-score was obtained by computing the mean of the six items, with higher scores reflecting more fatigue. Two examples of items are “Right now, I feel exhausted” and “Right now, I feel fatigued” (\( \alpha = .89 \) across all 5 days).

**Analyses**

The relationships between global WHI and the daily variables under study were examined using multilevel analysis (Hox, 2002; Snijders & Bosker, 1999). This method controls for the fact that our day-level data (level 1) are nested within persons (level 2), and, thus, are not independent of each other. It therefore yields more conservative estimates than ordinary least squares regression analysis. We used the MLWiN 2.0 software package (Centre for Multilevel Modelling, 2005) and all variables (except for age and contractual work hours) were standardized based on their grand mean.

For each of the daily measures (i.e., daily WHI, work activities by day, effortful work time, overtime, domestic activities, active leisure, low-effort leisure, sleep complaints, and fatigue) a series of analyses was conducted, in which the respective daily measure served as dependent variable. Although this procedure is not always in accordance with knowledge about “causes” and “consequences” of WHI (e.g., time spent on overtime is more likely to be a cause rather than a consequence of WHI), multilevel analysis requires the dependent
variable to be on the lowest (i.e., day) level. Moreover, we were not primarily interested in mapping causal relationships between global WHI and daily variables, but in disentangling associations between these measures.

For each daily measure, we started with a Null Model, in which only an intercept was specified. In Model 1, gender (0 = male, 1 = female), parental status (0 = no child(ren) living in the household, 1 = at least one child living in the household), age, and number of contractual work hours were included as possible covariates because these may affect the relationship between the daily variables in this study and global WHI. To acknowledge possible day-to-day variation in the respective daily dependent variable, in Model 2, Time was modelled by including the 5 days of the research period by means of four dummy variables (with Monday as a reference category). Global WHI was added as a predictor variable in Model 3. To examine the hypothesized increase in sleep complaints and fatigue for those experiencing relatively high levels of WHI, for these two daily variables an additional Model 4 was specified that included four Global WHI × Day interactions.

Results

Table I presents for all diary measures the means and standard deviations on each of the five week days for the whole sample. The relatively low amount of time spent on work activities (by day) on Wednesday (M = 5.74) and Friday (M = 5.71) is probably due to the fact that Dutch children under the age of 8 years old do not attend primary schools on Wednesday and Friday afternoons.

Correlations between the study variables are shown in Table II. These correlations are computed on basis of mean week scores (allowing for missing values on one or more measurement occasions), which explains why sample sizes in Table II are slightly higher (n between 97 and 120) than those in Table I (n between 67 and 96). Table III presents the multilevel estimates for models predicting the daily variables.

Question 1: How do global reports of WHI correspond with daily reports of WHI?

As evidenced by a statistically significant decrease in the −2 log-likelihood, Model 1 (in which the covariates are modelled) improved significantly upon the Null Model (p < .05), although none of the individual covariates reached significance (βgender = .35, n.s.; βparental status = −.15, n.s.; βage = −.00, n.s.; βcontract hours = −.02, n.s.). Model 2 included the Day effects, but did not fit better than Model 1. Finally, Model 3 fitted the data better than Model 2 (p < .001), revealing the expected association between global WHI and daily WHI (β = .49, p < .01, Hypothesis 1 supported; R² of this model = .31), but showing no significant relationship between any of the covariates and daily WHI.

Question 2: How do global reports of WHI relate to time spent daily on work-related activities?

With respect to work activities by day, Model 1 fitted the data better than the Null Model (p < .001). Daily work time was less for those with children (β = −.27, p < .05) and, not surprisingly, higher for those with more contractual work hours (β = .06, p < .01). Gender (β = .01, n.s.) and age (β = .00, n.s.) were unrelated to daily work time. A similar pattern of results for the covariates was observed in Model 2 (p < .01), which also showed that daily work time is lower on Wednesday (β = −.39, p < .01) and Friday (β = −.42, p < .01) than on Monday (the reference category). Model 3 (that included global WHI) did not fit better
Table I. Means and standard deviations of the diary measures for each day ($n$ varies from 67 to 96 depending on missing values; median $n = 85$).

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<td>Time spent on work activities (by day) $^a$</td>
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<td>6.33</td>
<td>1.92</td>
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<td>Overtime (evening) $^c$</td>
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<td>0.92</td>
</tr>
<tr>
<td><strong>Home activities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time spent on domestic activities $^{a+c}$</td>
<td>2.31</td>
<td>2.16</td>
<td>2.24</td>
<td>2.26</td>
<td>2.91</td>
</tr>
<tr>
<td>Time spent on active leisure $^{a+c}$</td>
<td>0.81</td>
<td>0.95</td>
<td>0.90</td>
<td>1.22</td>
<td>0.93</td>
</tr>
<tr>
<td>Time spent on low-effort leisure $^{a+c}$</td>
<td>0.91</td>
<td>0.99</td>
<td>0.90</td>
<td>0.85</td>
<td>1.25</td>
</tr>
<tr>
<td><strong>Recovery indicators</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep complaints $^m$</td>
<td>1.73</td>
<td>1.72</td>
<td>1.69</td>
<td>1.53</td>
<td>1.62</td>
</tr>
<tr>
<td>Fatigue (POMS) $^c$</td>
<td>1.70</td>
<td>0.72</td>
<td>1.77</td>
<td>0.69</td>
<td>1.82</td>
</tr>
</tbody>
</table>

$m = \text{ variable is measured in the morning, }^a = \text{ variable is measured in the afternoon, }^c = \text{ variable is measured in the evening.}
than Model 2, indicating that global WHI was unrelated to daily work time (*Hypothesis 2a rejected for work activities by day*). Regarding the time spent daily on *effortful work activities*, none of the specified models improved upon each other. Thus, this daily variable is not related to the covariates, the days of the week and global WHI (*Hypothesis 2a rejected for effortful work time*).

Finally, concerning *daily overtime (evening)*, Model 1 did not fit the data better than the Null Model, indicating that the covariates were not related to daily overtime. Conversely, Model 2 fitted significantly better than Model 1 (*p* < .001), showing that the time spent on overtime work was lower on Friday (*β* = −.54, *p* < .01) compared to Monday, but not on Tuesday (*β* = −.18, n.s.), Wednesday (*β* = −.13, n.s.), and Thursday (*β* = −.15, n.s.). This model did not include any significant effects of the covariates. A similar pattern of results was also observed in Model 3 (*p* < .001), which additionally revealed that global WHI was positively related to daily overtime (*β* = .21, *p* < .01, *Hypothesis 2b supported; *R*² of Model 3 = .09).

**Question 3: How do global reports of WHI relate to time spent daily on home activities?**

As for *domestic activities*, Model 1 fitted better than the Null Model (*p* < .001). Women (*β* = .26, *p* < .05) and employees with children (*β* = .76, *p* < .01) spent more time daily on domestic activities than men and those without children living in the household, whereas the number of contractual work hours was negatively related to the time spent daily on this type of activities (*β* = −.02, *p* < .05). Neither Model 2 nor Model 3 fitted the data better than Model 1, indicating that the time spent on domestic activities did not depend on day of the week and was unrelated to levels of global WHI (*Hypothesis 3a rejected*).

Regarding the time spent daily on *active leisure activities*, Model 1 fitted the data better than the Null Model (*p* < .05), showing that the time spent daily on these types of activity was negatively related to the number of contractual work hours (*β* = −.03, *p* < .05), but not to age (*β* = .01, n.s.), gender (*β* = .15, n.s.), and parental status (*β* = −.15, n.s.). Neither Model 2 nor Model 3 fitted the data better than Model 1, indicating that the time spent on active leisure activities did not vary with the day of the week or global WHI (*Hypothesis 3b rejected*).
Table III. Multilevel estimates for daily WHI, daily work activities, daily home activities, and daily recovery indicators.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model</th>
<th>–2 Log Likelihood</th>
<th>Level 2 intercept variance (SE)</th>
<th>Level 1 intercept variance (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Daily WHI (n = 393)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 0</td>
<td>1000.39</td>
<td>.51 (.09)</td>
<td>.50 (.04)</td>
<td></td>
</tr>
<tr>
<td>M 1</td>
<td>990.05*</td>
<td>.42 (.08)</td>
<td>.50 (.04)</td>
<td></td>
</tr>
<tr>
<td>M 2</td>
<td>983.61</td>
<td>.44 (.08)</td>
<td>.49 (.04)</td>
<td></td>
</tr>
<tr>
<td>M 3</td>
<td>928.76***</td>
<td>.20 (.05)</td>
<td>.49 (.04)</td>
<td></td>
</tr>
<tr>
<td><strong>Work-related activities</strong> (by day) (n = 408)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 0</td>
<td>1129.44</td>
<td>.21 (.06)</td>
<td>.78 (.06)</td>
<td></td>
</tr>
<tr>
<td>M 1</td>
<td>1094.45***</td>
<td>.08 (.04)</td>
<td>.79 (.06)</td>
<td></td>
</tr>
<tr>
<td>M 2</td>
<td>1080.96**</td>
<td>.08 (.04)</td>
<td>.76 (.06)</td>
<td></td>
</tr>
<tr>
<td>M 3</td>
<td>1079.19</td>
<td>.08 (.04)</td>
<td>.76 (.06)</td>
<td></td>
</tr>
<tr>
<td><strong>Effortful work activities</strong> (n = 408)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 0</td>
<td>1103.61</td>
<td>.31 (.07)</td>
<td>.68 (.05)</td>
<td></td>
</tr>
<tr>
<td>M 1</td>
<td>1100.72</td>
<td>.30 (.07)</td>
<td>.68 (.05)</td>
<td></td>
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<tr>
<td>M 2</td>
<td>1099.72</td>
<td>.30 (.07)</td>
<td>.68 (.05)</td>
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</tr>
<tr>
<td>M 3</td>
<td>1099.15</td>
<td>.30 (.07)</td>
<td>.68 (.05)</td>
<td></td>
</tr>
<tr>
<td><strong>Overtime (evening)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 0</td>
<td>1239.77</td>
<td>.24 (.06)</td>
<td>.76 (.06)</td>
<td></td>
</tr>
<tr>
<td>M 1</td>
<td>1236.45</td>
<td>.23 (.06)</td>
<td>.76 (.06)</td>
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</tr>
<tr>
<td>M 2</td>
<td>1217.23***</td>
<td>.24 (.06)</td>
<td>.72 (.05)</td>
<td></td>
</tr>
<tr>
<td>M 3</td>
<td>1205.94***</td>
<td>.19 (.05)</td>
<td>.72 (.05)</td>
<td></td>
</tr>
<tr>
<td><strong>Home activities</strong> (n = 400)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 0</td>
<td>1074.57</td>
<td>.31 (.07)</td>
<td>.67 (.05)</td>
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</tr>
<tr>
<td>M 1</td>
<td>1014.58***</td>
<td>.10 (.04)</td>
<td>.66 (.05)</td>
<td></td>
</tr>
<tr>
<td>M 2</td>
<td>1006.39</td>
<td>.10 (.04)</td>
<td>.64 (.05)</td>
<td></td>
</tr>
<tr>
<td>M 3</td>
<td>1006.06</td>
<td>.10 (.04)</td>
<td>.64 (.05)</td>
<td></td>
</tr>
<tr>
<td><strong>Active leisure activities</strong> (n = 400)</td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>.11 (.05)</td>
<td>.89 (.07)</td>
<td></td>
</tr>
<tr>
<td>M 1</td>
<td>1116.99*</td>
<td>.07 (.04)</td>
<td>.89 (.07)</td>
<td></td>
</tr>
<tr>
<td>M 2</td>
<td>1110.73</td>
<td>.08 (.04)</td>
<td>.87 (.07)</td>
<td></td>
</tr>
<tr>
<td>M 3</td>
<td>1110.72</td>
<td>.08 (.04)</td>
<td>.87 (.07)</td>
<td></td>
</tr>
<tr>
<td><strong>Low-effort activities</strong> (n = 400)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 0</td>
<td>1096.22</td>
<td>.31 (.07)</td>
<td>.71 (.06)</td>
<td></td>
</tr>
<tr>
<td>M 1</td>
<td>1090.25</td>
<td>.28 (.07)</td>
<td>.71 (.06)</td>
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</tr>
<tr>
<td>M 2</td>
<td>1037.19***</td>
<td>.29 (.07)</td>
<td>.60 (.05)</td>
<td></td>
</tr>
<tr>
<td>M 3</td>
<td>1033.25*</td>
<td>.27 (.06)</td>
<td>.60 (.06)</td>
<td></td>
</tr>
<tr>
<td><strong>Recovery indicators</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 0</td>
<td>1158.56</td>
<td>.28 (.07)</td>
<td>.72 (.06)</td>
<td></td>
</tr>
<tr>
<td>M 1</td>
<td>1150.70</td>
<td>.25 (.06)</td>
<td>.72 (.06)</td>
<td></td>
</tr>
<tr>
<td>M 2</td>
<td>1140.93*</td>
<td>.26 (.06)</td>
<td>.70 (.05)</td>
<td></td>
</tr>
<tr>
<td>M 3</td>
<td>1122.43***</td>
<td>.19 (.05)</td>
<td>.69 (.05)</td>
<td></td>
</tr>
<tr>
<td>M 4</td>
<td>1119.74</td>
<td>.19 (.05)</td>
<td>.69 (.05)</td>
<td></td>
</tr>
<tr>
<td><strong>Fatigue</strong> (n = 444)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 0</td>
<td>1108.52</td>
<td>.54 (.09)</td>
<td>.48 (.04)</td>
<td></td>
</tr>
<tr>
<td>M 1</td>
<td>1095.85*</td>
<td>.46 (.08)</td>
<td>.48 (.04)</td>
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<td>M 2</td>
<td>1086.75</td>
<td>.46 (.08)</td>
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<td>M 3</td>
<td>1061.25***</td>
<td>.33 (.06)</td>
<td>.47 (.04)</td>
<td></td>
</tr>
<tr>
<td>M 4</td>
<td>1051.25*</td>
<td>.33 (.06)</td>
<td>.45 (.03)</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05; **p < .01; ***p < .001.

Note: M0: Intercept only.
M1: Intercept, Covariates.
M2: Intercept, Covariates, Days.
M3: Intercept, Covariates, Days, Global WHI.
M4: Intercept, Covariates, Days, Global WHI, Global WHI × Day interactions.
Regarding the time spent daily on low-effort leisure activities, Model 1 (in which the effects of the covariates were modelled) did not improve upon the Null Model. Thus, the time spent daily on these activities was unrelated to age, contractual work hours, gender, or parental status. Model 2 fitted the data better than Model 1 ($p < .001$), revealing that employees on average spent more time on low-effort leisure activities on Wednesday ($\beta = .25, p < .05$) and Friday ($\beta = .83, p < .01$) than on Monday. This model also showed that employees with children spent less time daily on low-effort activities ($\beta = -.31, p < .05$) than those without children living in the household. This was also observed in Model 3, which improved significantly upon Model 2 ($p < .05$), and showed that global WHI was significantly negatively related to the time spent daily on low-effort leisure activities ($\beta = -.13, p < .05$; Hypothesis $3c$ supported; $R^2$ of Model $3 = .14$).

**Question 4: How do global reports of WHI relate to daily reported recovery indicators?**

With respect to sleep complaints, Model 1 did not improve upon the Null Model. However, Model 2 ($p < .05$) indicated that sleep complaints varied with the day of the week. Compared to Monday, sleep complaints were lower on Friday ($\beta = -.34, p < .05$) but not on other days. Also in this model, none of the covariates reached significance. This also applied to Model 3 ($p < .001$), which further revealed that global WHI was positively related to daily sleep complaints ($\beta = .27, p < .01$, Hypothesis $4a$ supported; $R^2$ of Model $3 = .12$). Inclusion of the Global WHI × Day interactions (Model 4) did not improve upon Model 3, meaning that the level of sleep complaints during the week did not depend on levels of global WHI (Hypothesis $4c$, which assumed an increase in sleep complaints over the working week for those experiencing high levels of global WHI, was rejected for sleep complaints).

As for fatigue, Model 1 fitted the data better than the Null Model ($p < .05$). Women generally reported higher levels of daily fatigue than men ($\beta = .36, p < .05$), whereas older employees were less fatigued than others ($\beta = -.02, p < .05$). Although Model 2 did not improve significantly upon Model 1, Model 3 fitted the data better than Model 2 ($p < .001$), revealing that global WHI was positively related to daily fatigue ($\beta = .36, p < .01$; Hypothesis $4b$ supported; $R^2$ of Model $3 = .21$). With respect to the covariates, only the effect of age remained significant in this model. Finally, Model 4, including the Global WHI × Day interactions, provided a better fit than Model 3 ($p < .05$). Thus, levels of daily fatigue during the week varied with the level of global WHI. A closer examination of the β-weights revealed that this interaction was significant on Thursday ($\beta = .30, p < .01$), but not on the other days of the week. As there was no consistent pattern of interactions, these results do not support Hypothesis $4c$ (which hypothesized an increase in fatigue during the workweek for those employees experiencing high levels of global WHI).

**Discussion**

The aim of this study was to gain insight in the short-term day-to-day experiences accompanying global reports of work–home interference. For this purpose, we investigated the relationships between these global reports of WHI and daily reports of WHI (research question 1), time spent daily on work-related activities (research question 2), and home activities (research question 3), and daily reported recovery indicators, as well as the course of recovery indicators over time (research question 4).
We found that reports of global WHI related positively to daily WHI, supporting the validity of our global WHI measure. However, it is also possible that this positive association reflects a common underlying response bias, as both measures contained identical items and only differed regarding when the interference had occurred: on a specific day (diary questionnaire), or generally (general questionnaire). Thus, to obtain further insight into the global WHI measure’s validity, these findings should be replicated with measures that show less overlap with regard to their items.

With respect to work-related activity patterns, global WHI was not related to daily activity patterns within the work domain as such (i.e., time spent daily on [effortful] work activities until 6 pm). However, we observed a relationship between global WHI and work activities carried out at the intersection of work and home life. That is, global WHI was positively related to the time spent on overtime work in the evening. Thus, especially employees reporting high levels of global WHI were still expending effort during the time that might be used to recover from load effects that were built up during regular work time.

Concerning home activities, we did not find the hypothesized negative relations between global reports of WHI and time spent daily on domestic and active leisure activities. In a sense this is understandable, as many domestic activities are obligatory in nature (e.g., it is difficult to circumvent doing the household chores or caring for one’s children), whereas active leisure activities are often part of routines (e.g., running 5 miles on Monday evenings) that will not be easily broken.

Furthermore, global WHI was negatively related to the time spent daily on low-effort leisure activities. This may be due to the fact that, in contrast to domestic and active leisure activities, one is relatively free in deciding whether to engage in this type of activity, which increases the possibility that work obligations will limit the time spent on them. As previous research (Sonnentag, 2001) revealed that engagement in low-effort activities contributes to recovery from work demands, our result suggests that the experience of global WHI is negatively associated with opportunities for recovery.

Regarding the subjective recovery indicators, this study showed that global WHI was positively related to fatigue and sleep complaints, indicating that WHI indeed reflects a lack of recovery. However, we found neither the expected increasing lack of recovery nor the increase in sleep complaints and fatigue during the workweek for those experiencing high levels of global WHI. The period of five consecutive weekdays covered by our study may have been too short for these differences to become visible. Further, the fact that some items of the POMS reflect extreme levels of fatigue may be responsible for the lack of results for this concept; this instrument may not be sensitive enough to measure differences in fatigue among healthy workers. Therefore, we conducted an additional multilevel analysis using an alternative single-item measure (“How fatigued do you currently feel”; 1 = “not at all,” 10 = “extremely,” measured in the evening questionnaire). This presumably more sensitive measure replicated the findings obtained for fatigue, as measured with the POMS, and also did not reveal an increase of fatigue across the week for those experiencing high levels of global WHI (results can be obtained from the first author). Thus, it may be that lack of sensitivity does not account for the absence of an increase in fatigue during the week for those experiencing relatively high levels of global WHI. However, it may also be that that the single-item measure is not sensitive enough to capture differences in fatigue among healthy workers either.

Although no firm inferences can be drawn from this study regarding the causal direction of the relationships between WHI and daily activities, the present findings are consistent with the position that WHI develops as a function of the time spent on overtime. If this is
correct, one practical, albeit preliminary, implication based upon our findings would be that employees should be cautious regarding the amount of time they spend on overtime in the evening, in order to limit the development of negative effects associated with WHI. It may also be important to reduce WHI itself, as this is negatively related to the time available for low-effort activities, which contribute to recovery (Sonnentag, 2001). This study’s finding that WHI is related to fatigue and sleep complaints (both indicators of lack of recovery) strengthens this position, as previous longitudinal research (e.g., Van Hooff et al., 2005) also identified WHI as a cause of such health complaints.

Limitations and suggestions for future research

We believe that six issues are worth discussing. First, our study relied exclusively on self-report measures, which may have resulted in an overestimation of the associations among the variables due to common method variance. However, this cannot explain why some relationships were found while others were not. Moreover, as Semmer, Grebner, and Elfering (2004) argue, alternative measures such as observational or physiological measures are not free of error variance either, and should therefore not be considered superior to self-report measures. In addition, Podsakoff, MacKenzie, Lee, and Podsakoff (2003) state that common method bias can be reduced by creating a temporal separation between the measurement of the predictor and the criterion variables. This procedure was followed in our study, as there was an approximately 10-day time lag between the completion of the general questionnaire and the start of the daily diary study. Thus, we believe that common method bias did not affect our findings severely. Future studies could further diminish the risk of common method variance by using physiological and performance measures in addition to self-reports.

Second, except for global WHI, daily sleep complaints and daily regular work time, the distributions of our variables were rather skewed (skewness ranged from 1.34 [SD = .12] for fatigue to 2.65 [SD = .12] for daily time spent on active leisure activities). To investigate whether this affected our results, we employed a square-root transformation on all variables and repeated the multilevel analyses with these normalized variables. The results of the new analyses were virtually identical to those obtained with the original data (results not reported but can be obtained from the first author). Thus, the skewness of our variables did not significantly affect the relationships found in this study.

A third issue relates to the composition of our sample. It would seem possible that employees experiencing very high levels of WHI are underrepresented in our study, as taking part in the study would place too great a burden on their already busy lives. Conversely, it is possible that particularly those employees who did not experience any WHI did not see the use in participating in the study, leading to an under-representation of this group as well. Neither alternative can be excluded, suggesting that the associations among the variables in this study have been estimated conservatively due to restriction-of-range effects in WHI. In addition, all participants were academic staff members, who work at least 3 days a week and who lived together with a partner who worked at least 2.5 days a week. This makes it difficult to generalize our findings to employees in other professions, in other family situations, or with other working hours. Thus, future studies should employ samples from other occupational groups to provide a clearer picture of how global WHI is related to various day-to-day outcome measures.

Fourth, our definition of overtime work as all work activities executed after 6 pm may be questioned. It is possible that for some employees this point of time does not correctly
reflect the transition from regular work time to overtime work. For example, for part-time workers, overtime work may have started earlier on the day, whereas for other employees, working after 6 pm is still part of one's normal work routine. However, in the case of part-time workers, our definition would have resulted in a restriction of range in overtime, and thus in conservative estimates of the relationship between overtime work and global WHI. For full-time workers, our definition is probably not so problematic either as, in The Netherlands, even academics usually fulfill their contractual work hours during regular “office hours”.

Fifth, our study focused on the time spent on various work and home activities, and paid only limited attention to the experience of each activity (namely by asking how effortful each work activity was experienced to be). These experiences (e.g., pleasure, detachment from work) may play a vital role in the understanding of the (absence of) associations between WHI and work and home activities. We therefore suggest that future studies pay attention to the experience of work and home activities.

Finally, our study was limited to five consecutive weekdays. To obtain more insight into the relationships between global WHI, activities, and recovery and to find out if and when the course of recovery starts diverging for groups of participants with different levels of global WHI, longer observation periods are needed during which a detailed level of assessment is practiced. Furthermore, as most opportunities for recovery exist during weekends and vacations, we recommend that future research assess these specific periods as well.

Contributions of this study

In spite of these important limitations, we believe that the present study extends and enhances previous research into WHI in at least two respects. First, this study adds to previous research by using a theoretical framework (Effort-Recovery theory) that seems to hold promise for studying WHI, and by addressing employees’ daily activities in the work and home domain. That is, by mapping employees’ activity patterns at work and at home and by relating these to their global experience of WHI, this study obtained a detailed picture of how WHI is related to what people do in their everyday lives. Further, this study underlined the potential of Effort-Recovery theory for studying WHI. It shows that global WHI is positively related to the amount of effort expended on a day-to-day basis (i.e. the positive association found between global WHI and the time spent on overtime in the evening), and negatively to opportunities to recover from work demands (i.e. the negative association found between global WHI and the time spent on low effort activities). Consistent with previous findings (Van Hooff et al., 2005), WHI was indeed positively associated with health complaints reflecting lack of recovery (i.e. fatigue, sleep complaints). Also, the percentage of variance accounted for in these variables was quite acceptable and ranged from 9% for overtime work to 31% for daily WHI.

Second, our study underlines the validity of global measures of WHI by showing that differences in levels of global WHI for an individual are reflected in day-to-day reports of WHI. This is an important finding, in that virtually all instruments used to tap WHI globally. Our findings suggest that instruments such as the SWING, which was developed by the authors, mirror workers’ real day-to-day experiences and problems in combining their multiple roles in the work and home domain. In this sense, we believe that our study also provides interesting insights in what a global report, for the individual, of WHI actually signifies from day to day.
Acknowledgements

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