Putting the Effort-Recovery Model to the Test: Comparing Healthy and Chronically ill Workers Across Occupation-Stratified Samples

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Abstract

The effort-recovery model was tested in four occupation-stratified samples (health care, education, blue collar, and white collar workers). The aim was to examine: a) whether need for recovery mediates the relationship between stress-provoking working conditions and employee health (absenteeism and work injuries), b) if this mediation relationship is stronger for the chronically ill compared to healthy workers, and c) whether these relationships are consistently present across samples. Data were extracted from the NCWS 2003, and analyzed using logit models in a multi-sample design. Need for recovery was found to mediate the relationship between occupational stressors and absenteeism. In the blue collar sample, need for recovery also mediated the relationship between occupational stressors and work injuries. Chronic illness positively affected need for recovery across samples, and moderated the relationship between autonomy and need for recovery in the health care sample. The take-away message is to focus more on worker characteristics, than working conditions, in the effort-recovery model.

Keywords: Effort-recovery model, Psychosocial work characteristics, Need for recovery, Chronic illness, Absenteeism, Work injuries.

Introduction

Over the last decades, Western capitalist societies have experienced profound socio-economic changes, characterizing a transition from a Fordist to a Post-Fordist capitalist society (Lipietz, 1987). The former entails a society in which Taylorist production regimes had a central place and employment conditions entailed "the same job for life, a stable identity rooted in one's permanent employment, a predictable schedule, a relatively stable income, and the performance of repetitive manual labor" (Brophy, 2008, p. 13). From the 1970s onward, in the context of neo-liberalism's rise, the privatization activity in the public sector, and a deregulated open world economy (Cooper, 2002), the Post-Fordist capitalist society emerged, emphasizing flexibility as the approach to ensure sustainable economic growth (OECD, 1998).

In the Post-Fordist capitalist society, the content of work mainly revolves around combining skills and knowledge in problem identifying and solving processes, as to produce (im)material goods and services (Ackerman et al., 1998; Vanroelen et al., 2009). The employment relationship is characterized by the presence of more flexible and contingency working (Benach & Muntaner, 2007; Cooper, 2002), and "a 'longer hours' culture in organizations, greater mobility between employers, and more portfolio careers" (Cooper, 2002, p. 355). Furthermore, Shore et al. (2004, p. 338) noticed a transformation of the psychological contract from "the offer of job security and continuity in exchange for loyalty, towards a transactional relationship that emphasizes flexibility and employability".

The transition into the Post-Fordist era has brought about different stressors related to the labor process (De Jonge & Kompier, 1997) because work has become mentally, rather than physically, demanding (Zijlstra, Schalk, & Roe, 1996), creating more stress-provoking work environments (Benach & Muntaner, 2007; De Croon et al., 2002). As a result, researchers have introduced various job demands ("psychological stressors involved in

accomplishing the work load"; Karasek, 1979, p. 291) and aspects of decision latitude (a worker's ability to control activities and skills usage; Karasek & Theorell, 1990) to better capture the present-day psychosocial work environment and explain more of the variation in health-related outcomes (Benach & Muntaner, 2007; Cooper, 2002). In contrast to the large number of studies exploring relationships between stress-provoking working conditions and employee health and well-being, it has only been in the past decade that researchers devoted more attention to the intermediating links explaining how occupational stressors lead to health problems in the long run (De Croon, Sluiter, & Frings-Dresen, 2003).

In particular, 'need for recovery' is postulated as the key process linking job demands and employee health and well-being. Sluiter et al. (2003) defined 'need for recovery' as the short-term effect of a working day, and posited that exposure to high job demands and low control increases an individual's need for recovery, which in turn affects subjective health complaints (Sluiter, Van der Beek, & Frings-Dresen, 1999; Sonnentag & Zijlstra, 2006). Need for recovery is becoming increasingly important in the Post-Fordist era because opportunities to recover tend to decline (e.g., irregular hours; Zijlstra & Sonnentag, 2006), and work itself places more demands on people's physical and, in particular, psychological resources (e.g., extended working days or distance work; Sluiter et al., 1999; Zijlstra et al., 1996).

Most research on need for recovery is based on samples composed of 'healthy' employees, apart from a rare exception (Weijman et al., 2004), but one might conjecture that the detrimental effects of occupational stressors are even stronger for those diagnosed chronically ill. For example, Jansen et al. (2003) showed that increased need for recovery is associated with variable schedules in a sample of healthy workers. This effect is likely to be stronger for workers suffering from diabetes, which is a self-managed disease that requires a patient to perform series of day-to-day disease-related tasks. It might be difficult to coordinate these tasks when working under a variable schedule. Hence, working conditions may provide

challenges for the healthy worker but at the same time pose serious problems for the chronically ill.

The necessity to investigate whether the 'need for recovery process' differs between healthy and chronically ill workers is particularly pressing in the European context, where governments stimulate labor participation and employability through active labor market policies based on the idea of (paid) work as an obligation of citizenship (Cox, 1998). The latter is formalized in the European growth and jobs strategy (European Commission, 2007), which builds on the concept of 'flexicurity' (Wilthagen, 1998). In a nutshell, flexicurity can be conceived of as balancing on the one hand a need for labor market flexibilization through deregulation, and on the other hand a need for – employment and social – security for workers through active labor market policies (Wilthagen, 1998; Wilthagen & Tros, 2004).

This strategy is based on budgetary considerations by cutting expenditures on social security (e.g., tightening eligibility criteria to welfare benefits) and ideological considerations by championing labor participation as an intrinsic good for both society and individual (Cox, 1998). A Dutch example of legislation that aligns with this labor market strategy is the 'Work According to Ability Act' (Rijksoverheid, 2012a). In a time where active labor participation of the chronically ill is (morally) expected and (legislatively) stimulated, it is vital to examine whether the mediating role of need for recovery between occupational stressors and health-related outcomes differs between chronically ill and healthy workers.

In this study, we use data from The Netherlands Working Conditions Survey 2003 (NWCS)[1] and examine: a) whether need for recovery mediates the relationship between stress-provoking working conditions (job demands) and employee health (i.e., illness-related absenteeism and work-related injuries), b) if this mediation relationship is stronger for the chronically ill compared to healthy workers, and c) whether these proposed relationships are (consistently) present across different occupation-stratified samples.

The Effort-Recovery Model: Antecedents and Consequences of Need for Recovery

The construct 'need for recovery' is best understood by examining the model from which it originates; viz., the effort-recovery model (cf. Meijman, 1989; Meijman & Mulder, 1998; Meijman & Schaufeli, 1996). This model introduces the term 'work procedure', which is defined by three interacting determinants. First, *work demands*, which is an umbrella term for all the task demands and psychosocial factors in the work environment. Second, *work potential* summarizes the actual mobilization of ability and effort that a worker is able and willing to bring to the table at any given time to meet the work demands (Meijman & O'Hanlon, 1983). The final determinant is *decision latitude*. Together these three determinants constitute the work procedure, emphasizing that the way work is done depends on situational as well as personal characteristics (Van Veldhoven, 2008). The work procedure eventually amounts to two types of outcomes, which are the end product or service and short-term physiological and psychological reactions (i.e., *load effects*; Meijman & Mulder, 1998).

Load effects encompass behavioral, physiological, and emotional reactions to work demands, and their magnitude is contingent upon decision latitude and work potential. These effects constitute short-term fatigue after work (Meijman & Mulder, 1998; Meijman & Schaufeli, 1996) and are reversed when the exposure to work demands ceases; that is, when work stops, in a process named recovery (Craig & Cooper, 1992). Ideally, the recovery process, in which fatigue symptoms are reversed, takes place the same day or before the next working day. With enough opportunities to recuperate (during breaks at work or after work), a worker can begin the next day free of any residual symptoms related to the previous work endeavor; that is, without a need for recovery. However, when a worker has insufficient opportunities for recovery, (s)he begins the next working day suffering from residual work-induced fatigue, known as spillover (Dienstbier, 1989), which may instigate a cumulative process (Kompier, 1988) that eventually leads to detrimental and irreversible *load*

consequences (i.e., mental and physical health problems; Dienstbier, 1989; Knardahl & Ursin, 1985) that are likely to result in poor work performance and safety behavior. Need for recovery is considered a key process linking reversible and irreversible health complaints (De Croon et al., 2002; Meijman & Mulder, 1998; Sluiter et al., 1999; Sonnentag & Zijlstra, 2006).

Antecedents of need for recovery.

Following this formal outline of the effort-recovery model, it is worth considering in more detail the model's empirical implications. A first important implication posited by the model is that work demands have a positive – and decision latitude a negative – effect on load effects, and ipso facto, on need for recovery. In other words, a worker's need for recovery substantially increases when job characteristics are unfavorable; that is, high work demands in combination with low decision latitude (Sluiter et al., 1999; Sonnentag & Zijlstra, 2006). Studies have corroborated this additive hypothesis (e.g., De Raeve et al., 2007; Sonnentag & Zijlstra, 2006), which is in line with the psychological strain hypothesis (Karasek & Theorell, 1990). Instead of using fairly generic measures of work demands and decision latitude to test this combinatory hypothesis, we focus on one aspect of decision latitude; viz., autonomy, and make a further distinction in quantitative, physical, and emotional work demands.

Workers who experience a high degree of *autonomy* are able to regulate their level of effort investment by controlling work speed, deciding on work methods, and determining when to pause or switch to less demanding tasks (Jackson et al., 1993), whereas those in low autonomy jobs lack these opportunities when they feel overtaxed (Sonnentag & Zijlstra, 2006). Several studies confirmed the (positive) negative effect of (a lack of) autonomy on need for recovery (e.g., De Croon et al., 2004; De Raeve et al., 2007; Eriksen et al., 2006; Sluiter et al., 2003; Sonnentag & Zijlstra, 2006; Zijlstra & Sonnentag, 2006).

Quantitative demands are considered important antecedents of need for recovery (De Croon et al., 2004; De Raeve et al., 2007; Eriksen et al., 2006; Jansen et al., 2003; Van Veldhoven & Broersen, 2003), which makes sense intuitively, because working fast and excessively hard, or having insufficient time to complete tasks, is bound to lead to a higher need for recovery. In the same vein, *physical* demands, such as carrying and lifting heavy loads, intensive machine handling, but also exposure to risks and hazards, are associated with a higher need for recovery (e.g., De Croon et al., 2004; De Raeve et al., 2007; Eriksen et al., 2006). For instance, Sluiter et al. (2003) found across different occupations (construction workers, ambulance workers, and hospital nurses) a large effect of physical demands on work-induced fatigue.

Another characteristic of the labor process are *emotional* demands, particularly in occupations where workers face death, sickness, and human suffering on a daily basis, or regularly encounter aggressive patients, clients, supervisors, or colleagues. Positive correlates are found between on the one hand emotional demands and on the other hand burnout, psychological symptoms (i.e., nervousness, sleeping difficulties, anxiety, tension, tiredness, and sadness; Soderfeldt et al., 2000) and need for recovery (Sluiter et al., 2003). In line with the additive hypothesis previously derived from the effort-recovery model, we hypothesize,

Hypothesis 1: Work demands (quantitative, physical, and emotional demands) have a positive effect on need for recovery.

Hypothesis 2: Autonomy has a negative effect on need for recovery.

Consequences of need for recovery.

The effort-recovery model further posits that insufficient recovery leaves individuals with residual work-induced fatigue, which in the long run leads to cumulative fatigue

(Kompier, 1988), causing physical and mental health problems (load consequences; Knardahl & Ursin, 1985). Two variables, indicative of load consequences, are used in this study; namely, *illness-related absenteeism* and *work-related injuries*. Illness-related absenteeism is indicative of impaired health and well-being, and previous studies have provided ample evidence of need for recovery as an important predictor of prospective absenteeism (De Croon et al., 2003; Sluiter et al., 2003), and subsequent duration and frequency of sickness absence (Van Veldhoven, 1996). Work-related injuries are an indication of load consequences because of fatigue's dual role in the causation of accidents (Swaen et al., 2003); that is, fatigue may delay information processing in a risky work environment and compromise an individual's capability to respond effectively. Swaen et al. (2003), in a prospective study, presented evidence that workers with a high need for recovery are at greater risk of suffering from a work-related injury. Hence, we hypothesize,

Hypothesis 3: Need for recovery positively relates to illness-related absenteeism and work-related injuries.

The role of work potential: Being healthy or chronically ill.

The mediation mechanism that runs from work demands to load consequences, via load effects, has, though in different ways, been subjected to empirical scrutiny (e.g., Sluiter et al., 2003). An aspect of the model that has hitherto received less attention is the determinant work potential. Meijman and O'Hanlon (1983) described work potential as a construct that both taps the ability and the effort a worker demonstrates to meet work demands. In this study, we operationalize work potential in terms of chronic illness. Workers who suffer from one or more chronic diseases have to cope with both work demands as well as their medical condition; hence, they are more at risk to develop fatigue-related complaints in comparison

with healthy workers. Weijman et al. (2004), in a comparative study on need for recovery between diabetic and healthy workers, found no significant difference between both, however, diabetics with co-morbidity did show significantly elevated levels of need for recovery compared to healthy workers.

In addition to a direct effect of chronic illness on need for recovery, one might conjecture that the detrimental effects of work demands are more pronounced for the chronically ill than for healthy workers. For example, physical demands, such as lifting or carrying heavy loads, or quantitative demands, like a high work pace, induce more fatigue in a worker suffering from rheumatic arthritis. Emotional demands, like dealing with aggressive patients, clients, or coworkers is more exhausting for a worker suffering from chronic bronchitis. Furthermore, a lack of autonomy prohibits a worker to regulate his/her level of effort investment (taking breaks, switching tasks, controlling work speed), which is more problematic if (s)he has to attend a treatment regime (medicating or resting). Based on the aforementioned, we hypothesize,

Hypothesis 4: Chronic illness has a positive effect on need for recovery and amplifies the effects of work demands and autonomy on need for recovery.

Chronic illness probably also has direct relationships with illness-related absenteeism and work-related injuries. The relationship with absenteeism is rather obvious, with respect to the latter one could argue that the chronically ill worker is more at risk of experiencing a work-related injury due to his/her medical condition. More importantly, psycho-biological studies have shown that the recovery process after work depends on a number of worker characteristics and, in particular, on the individual's health status (Dienstbier, 1989). Frankenhaeuser and Johansson (1986) stated that the recovery process takes place fastest in

healthy and well-rested people, and at a much slower pace in those suffering from impaired health (also, see Kuijper, Van der Beek, & Meijman, 1998). This implies that a chronically ill worker is more at risk to undergo the cumulative process (Kompier, 1988) than a healthy worker. Thus, the effect of need for recovery on load consequences should be stronger for the chronically ill. Stated otherwise,

Hypothesis 5: Chronic illness positively relates to illness-related absenteeism and work-related injuries, and amplifies the effects of need for recovery on illness-related absenteeism and work-related injuries.

Combining the postulated hypotheses, we obtain the following operationalization of the effort-recovery model, which serves as the conceptual framework in this study.

Insert figure 1 about here

Method

Participants

In this study, we use cross-sectional data from the NCWS, which is a Dutch survey conducted by TNO in 2003. The sample design and the survey's underlying rationale have been described extensively elsewhere (cf. Van den Bossche & Smulders, 2003). However, instead of testing the postulated hypotheses using the complete NCWS sample, we extract four occupation-stratified samples (i.e., health care workers, education workers, blue collar workers, and white collar workers) from the complete data set and test the posited hypotheses across these different samples of workers as to explore the generalization of the effort-recovery model. An additional advantage of using occupation-stratified samples is that it

allows one to control for confounding variables, assuming the sample is homogeneous vis-a-vis these variables (Kristensen, 1995). For example, health care workers show little variance on an influential – and possibly confounding – variable like socio-economic status (De Croon et al., 2003; De Jonge, Mulder, & Nijhuis, 1999; Sluiter et al., 2003).

Measures

Antecedents: Work demands and autonomy.

Autonomy is measured by five items extracted from the decision latitude subscale, which is part of the Job Content Questionnaire (JCQ; Karasek et al., 1998). The content of the five items extracted concerns whether a worker is able to choose his/her preferred work method and the planning of the subsequent tasks. Karasek et al. (1998) showed that the decision latitude scale meets the desired psychometric properties. A sample item is: "Are you able to choose your own work method?" The items have answer categories ranging from 1 (never) to 4 (always).

Quantitative demands are assessed by means of the 'pace and amount of work' scale, which is an eleven-item subscale from the Dutch Questionnaire on the Experience and Assessment of Work (VBBA; Van Veldhoven & Meijman, 1994; Van Veldhoven et al., 2002). Sample items are: "Do you have to work very fast?" and "Do you have problems with the work pace?" The items' answer categories vary from 1 (never) to 4 (always). Van Veldhoven et al. (2002) extensively reported on the psychometric properties of the scale, which are considered satisfactory.

Physical demands are assessed by nineteen items that cover three important aspects: lifting, body posture, and repeating movements. The first eight items measure lifting heavy loads and lifting in uncomfortable positions. A sample item is: "Do you have to lift loads from an uncomfortable position?" The next eight items concern body posture, and a sample item is: "In your job, do you have to stand for a long time?" The final three items are about repeating

movements, and a sample item is: “In your job, do you have to repeat the same movement a number of times per minute?” All items have answer categories ranging from 1 (seldom) to 4 (often). A principal components analysis revealed that the scale composed of these nineteen items is unidimensional.

Emotional demands are assessed using the ‘emotional load’ scale, which is a seven-item subscale from the VBBA (Van Veldhoven & Meijman, 1994; Van Veldhoven et al., 2002). The psychometric properties of this subscale were evaluated by Van Veldhoven et al. (2002), and are deemed acceptable. Sample items are: “Does your work demands a lot from you emotionally?” and “Do you feel personally attacked or threatened in your work?” The items’ answer categories vary from 1 (never) to 4 (always). Table 1 presents the test-score reliability estimates for each of the work demands scales used per sample of workers. Table 1 shows that for most work demands scales test-score reliabilities are reported that can be qualified as excellent. The test-score reliabilities pertaining to the emotional demands scale are somewhat lower across the samples, particularly for the white collar workers, nevertheless, the values reported are of acceptable magnitude.

Need for recovery.

Work-related fatigue (need for recovery) is assessed by means of the ‘need for recovery after work’ scale, which is a subscale of the VBBA (Van Veldhoven & Meijman, 1994; Van Veldhoven et al., 2002). The scale is composed of eleven items, and is considered reliable and valid (Van Veldhoven, 1996; Van Veldhoven & Broersen, 2003). Sample items are: “At the end of a working day I am really feeling worn out” and “My job causes me to feel rather exhausted at the end of a working day”. The dichotomous items are answered yes/no. Table 1 shows acceptable test-score reliabilities across the workers’ samples for ‘the need for recovery after work’ scale.

Insert table 1 about here

Chronic illness.

Workers were asked to indicate whether they suffer from one or more chronic illness(es) or not, and if they do, to specify the type(s) of chronic illness(es) they suffer from (e.g., chronic bronchitis, diabetes, rheumatic arthritis). In this study, a three-way ordinal distinction is made in healthy workers who do not suffer from chronic illness, workers who suffer from *one* chronic illness, and workers who suffer from two or more chronic illnesses. As a result, chronic illness is operationalized as a three-category variable, classifying workers into healthy workers (healthy), chronically ill workers (ill), and chronically ill workers with co-morbidity (co-morbid).

Load consequences.

Illness-related absenteeism is operationalized as a two-category variable indicating whether a worker has been reported absent one or more times or not over a period of twelve months. Work-related injuries are measured by a dichotomous variable, with workers classified in two categories: those who have experienced one or more work-related injuries, and those who have experienced no such injury.

Demographic/control variables.

Three control variables – age, gender, and average work hours – are included in the analyses, which are likely to vary within the occupation-stratified samples. Previous studies have shown that age is positively associated with need for recovery, meaning that the recovery process slows down with increasing age (De Zwart, Frings-Dresen, & Van Dijk, 1995; Kiss, De Meester, & Braeckma, 2007). The jury is still out on whether there are gender-related differences with respect to need for recovery (e.g., Kinnunen, Mauno, & Siltaloppi, 2010; Van Veldhoven, 2008; Van Veldhoven & Broersen, 1999). Average work hours is

included because working more hours per week implies a longer exposure to occupational stressors, less time for recovery and, ipso facto, a higher need for recovery (De Croon et al., 2003; Sluiter et al., 1999).

Analytics

The software program SPSS (version 16.0) is used throughout the analyses in this study to apply various statistical techniques. The analyses comprise two consecutive steps. First, the antecedents of need for recovery are subject of investigation using gender, weekly work hours, and age-controlled limited-dependent variable models. Need for recovery is treated in this study as a discrete variable, classifying workers into two categories; viz., those who reported none or a mild need for recovery (Low; scores 0 through 5), and workers who reported a moderate to severe need for recovery (High; scores 6 through 11). The reason for doing so is that the test scores pertaining to the 'need for recovery after work' scale are skewed extremely positive, prohibiting the use of multivariate regression techniques.

An alternative would be to treat need for recovery as an ordinal variable with more than two categories and to use more complex limited-dependent variable models. Two reasons prevent us from taking this alternative route. First, ordinal regression models (e.g., proportional odds or adjacent categories models) assume the relationships between the independent variables and the (cumulative or adjacent) logit to be the same for all logits. Analysis pointed out that this assumption does not hold. Second, we use a large number of independent variables and product variables, which introduces sparseness in the contingency table, rendering unstable solutions. We did not consider multinomial models because it would, due to the number of variables considered, seriously complicate the interpretation of the analyses. As a result, we treat need for recovery as a two-category variable and use binary logistic regression models in the subsequent analyses.

In the second step, the consequences of need for recovery are examined by applying Baron and Kenny's (1986) mediation framework in the context of logistic regression modeling. In both steps healthy workers, chronically ill workers, and chronically ill workers with co-morbidity are compared by estimating models across the different samples of workers, in a so called multi-sample design.

Results

Descriptive Results for the Different Samples of Workers

Table 2 shows descriptive statistics for the four samples of workers under study. The first sample is composed of health care workers, which are professionals within medicine, nursing, or a field of allied health. The second sample concerns professional educators, e.g., high-school teachers or primary-school teachers. The third sample is made up of blue collar workers, who are, generally speaking, members of the working class performing manual labor in manufacturing, construction, maintenance, or are involved in mechanical work. The last sample comprises white collar workers who perform professional, managerial, or administrative work (e.g., managers, receptionists, or auditors).

Table 2 provides for each variable included the mean and standard deviation (SD) if continuous, or the percentage of a particular response when discrete. When eyeballing the table it is clear that blue collar and health care workers report higher physical demands compared to education and white collar workers. Education workers, compared to the other samples, are more likely to fall in the category high need for recovery. The blue collar worker reports the highest average weekly work hours compared to the other samples. As can be expected, white collar workers report the lowest percentage of work-related injuries. Lastly, the table shows that most health care occupations are held by women, while blue collar jobs are dominated by men.

Insert table 2 about here

Antecedents of Need for Recovery

Five logistic regression models are specified to examine the effects of different antecedents and chronic illness on the probability of high need for recovery. The first model (M_1) incorporates the main effects of the antecedents previously discussed (i.e., quantitative demands, emotional demands, physical demands, and autonomy) and a main effect of chronic illness, while controlling for age, gender, and average work week. In each consecutive model, one of four interaction terms is added to examine whether the effect of autonomy – or of one specific type of work demands – on need for recovery differs across healthy workers, chronically ill workers, and chronically ill workers with co-morbidity. Table 3 specifies the exact configuration of each of the five logit models. Note that the reference category is presented within parentheses for discrete variables.

Insert table 3 about here

The reason for estimating five logistic regression models across the four occupation-stratified samples instead of performing sequential analyses, in which interaction effects are added consecutively, is that a sequential analysis would lead to unstable results (i.e., inflated standard errors) due to multicollinearity. The five logistic regression models are estimated for each sample separately, and model fit is evaluated using the likelihood-ratio test statistic (G^2). The likelihood-ratio test statistic tests the null hypothesis that an estimated model holds against the saturated model, and can be expressed as the difference in maximized log likelihood of an estimated model (M_I) and the saturated model $(M_S;$ Agresti, 2002, p. 139); that is,

$$G^2(M_1 \mid M_s) = -2 \log \frac{Maximum\ \ likelihood\ \ for\ the\ model}{Maximum\ \ likelihood\ \ for\ the\ saturated\ model}.$$

More importantly, G^2 can be used as a relative test by testing a model against an alternative model that is more restrictive than the saturated model but less restrictive than the model tested. The difference in maximized log likelihood between nested models has an asymptotic chi-square distribution with degrees of freedom equal to the difference in regression parameters. Given that M_1 is nested in logit models two through five, G^2 can be used to assess whether adding one interaction effect significantly improves the prediction of high need for recovery. Table 4 presents the goodness-of-fit statistics for the five logit models across the four samples of workers.

Insert table 4 about here

With respect to health care workers, logistic regression model five (M_5) outperforms M_1 when it comes to predicting high need for recovery; that is, $G^2(M_1 \mid M_5) = 769.6 - 760.1 = 9.5,$ with $\chi^2(2) = 9.5$, $p < .01$, explaining 29% of the variance in need for recovery. For the education, blue collar, and white collar workers samples the conditional likelihood-ratio tests pointed out that none of the four extended models does a significantly better job at predicting high need for recovery than M_1 ($R^2 = .36$ for education workers; $R^2 = .30$ for blue collar workers; and $R^2 = .25$ for white collar workers), attaining a 1% significance level. Next, we interpret the best-fitting model for each sample separately.

The health care workers sample.

Table 5 shows the logistic regression coefficients (b), the standard errors (SE), and the odds ratios (OR) of the independent variables from the best-explaining model for each sample separately. The probability modeled is in all samples high need for recovery.

Insert table 5 about here

In line with hypothesis one, there are positive effects of quantitative demands (b = 1.78, $\chi^2(1) = 54.3, p < .001$) and emotional demands (b = .53, $\chi^2(1) = 5.47, p = .02$) on need for recovery in the sample of health care workers. No significant effect is found of physical demands (b = .29, $\chi^2(1) = 3.56, p = .06$) on need for recovery; hence, hypothesis one is only corroborated with respect to quantitative and emotional demands. Quite substantial positive associations are found between chronic illness (i.e., ill, b = 2.97, $\chi^2(1) = 8.47, p < .01$; co-morbid, b = 4.35, $\chi^2(1) = 11.13, p < .001$) and need for recovery. In words, the odds of high need for recovery, compared to healthy workers, are more than nineteen times larger for the chronically ill and nearly seventy-eight times larger for those who are chronically ill and suffer from additional health issues. However, the odds ratio, comparing chronically ill workers with co-morbidity to chronically ill workers, does not differ significantly from one ($b = 4.35 - 2.97 = 1.38, \chi^2(1) = .97, p = .32$), which indicates that there is no significant difference between the latter two categories of chronic illness on the probability of high need for recovery.

Chronic illness also acts as a moderator in the relationship between autonomy and need for recovery, $\chi^2(2) = 9.27, p = .01$. More specifically, the effect of autonomy on need for recovery does not differ significantly from zero for healthy workers (b = .13, $\chi^2(1) = .31, p = .58$), however, it is negative for chronically ill workers (b = –.77), and even more negative (b = –1.05) for chronically ill workers with co-morbidity. In other words, the odds of high need for recovery, compared to healthy workers, are 2.86 $[1/\exp(-1.05)]$ times smaller for chronically ill workers with co-morbidity and 2.16 $[1/\exp(-.77)]$ times smaller for chronically ill workers, assuming all experience the same level of autonomy.

The effect of autonomy on need for recovery is not significantly different between the chronically ill with co-morbidity and the chronically ill ($b = -1.18 + .90 = -.28$, $\chi^2(1) = .31, p = .58$). These results imply that autonomy is more important for the chronically ill with(out) co-morbidity than for healthy workers. The rationale might be that a certain level of autonomy provides opportunities for recovery, which is especially important for workers suffering from chronic illness(es) because it enables them to switch tasks, to relax certain body parts, or to pause to take medication or to rest. This finding in part corroborates hypothesis four, and provides evidence in favor of hypothesis two.

The education workers sample.

A positive effect is found of quantitative demands on need for recovery (b = 2.39, $\chi^2(1) = 34.11, p < .001$), which means that higher quantitative demands are associated with an increased probability of high need for recovery. Autonomy had a small positive but not significant effect on need for recovery (b = .08, $\chi^2(1) = .07, p = .79$). Most striking is the absence of a significant positive effect of emotional demands on need for recovery (b = .48, $\chi^2(1) = 1.72, p = .19$) in this particular sample. One would expect high-school teachers, primary-school teachers, or other education professionals to experience difficult and stressful social interactions with students, parents, or colleagues from time to time. Thus, hypothesis one is only corroborated with respect to quantitative demands, and no evidence is found in favor of hypothesis two. Similarly as in the sample of health care workers, there is a strong positive effect of chronic illness on need for recovery, $\chi^2(2) = 10.70, p < .01$. The odds of high need for recovery, in comparison with healthy workers, are more than two times larger for the chronically ill, and more than three times larger for the chronically ill with co-morbidity.

The odds ratio, comparing chronically ill workers with co-morbidity to chronically ill workers, does not differ significantly from one ($b = 1.18 - .75 = .43, \chi^2(1) = .96, p = .33$), which means that there is no significant difference between the categories 'ill' and 'co-morbid' on the probability of high need for recovery. As M_1 is deemed the best-fitting model for this particular sample, one may conclude that there are no significant moderation effects of chronic illness on the relationships between work demands and/or autonomy, and need for recovery. Hypothesis four is corroborated insofar as that a positive main effect is found of chronic illness.

The blue collar workers sample.

Positive effects are found of quantitative demands (b = 2.0, $\chi^2(1) = 125.4, p < .001$) and emotional demands (b = .69, $\chi^2(1) = 15.1, p < .001$) on need for recovery in the blue collar sample. Unexpectedly, the small positive effect of physical demands on need for recovery proved not significant (b = .08, $\chi^2(1) = .56, p = .45$). Particularly in this sample of workers one would anticipate a positive effect of this type of work demands, given the physical nature of blue collar work. Furthermore, a small negative effect is found for autonomy, which however, failed to reach the level of significance (b = –.16, $\chi^2(1) = 2.68, p = .10$). So, there is support for hypothesis one, but none for hypothesis two.

In line with the previous results, chronic illness is positively associated with need for recovery, $\chi^2(2) = 31.50, p < .001$. The odds of high need for recovery, compared to healthy workers, are nearly three times larger for chronically ill workers with co-morbidity. Upon further inspection, the odds ratio, comparing chronically ill workers to healthy workers, did not differ significantly from one ($b = .30, \chi^2(1) = 3.21, p = .07$). However, the odds of high need for recovery are 2.16 times larger for chronically ill workers with comorbidity compared to chronically ill workers ($b = 1.07 - .30 = .77, \chi^2(1) = 12.79, p < .001$). Given that M_1

provided the best fit to the data, one can conclude that no significant moderation effects exist of chronic illness on the relationships between work demands and/or autonomy, and need for recovery. Thus, there is some support for hypothesis four in the main effect of chronic illness on need for recovery.

The white collar workers sample.

In line with hypothesis one, positive effects are found of quantitative demands (b = 1.77, $\chi^2(1) = 205.09, p < .001$), emotional demands ($b$ = .83, $\chi^2(1) = 38.14, p < .001$), and physical demands (b = .24, $\chi^2(1) = 5.40, p = .02$) on need for recovery. Furthermore, autonomy is negatively associated with need for recovery (b = –.28, $\chi^2(1) = 11.88, p < .001$), which corroborates hypothesis two. In agreement with previous results, chronic illness is positively associated with need for recovery, $\chi^2(2) = 35.42, p < .001$. Compared to healthy workers, the odds of high need for recovery are almost one-and-a-half times larger for chronically ill workers, and almost two-and-a-half times larger for chronically ill workers with co-morbidity. Furthermore, the odds of high need for recovery are 1.72 times larger for chronically ill workers with comorbidity compared to chronically ill workers ($b = .85 - .31 = .54, \chi^2(1) = 12.12, p < .001$). In sum, a positive effect is found of chronic illness on need for recovery, but given that M_1 provided the best fit to the data, no evidence is found in support of chronic illness moderating the effects of work demands and/or autonomy on need for recovery. Hence, hypothesis four is partially corroborated.

Summary of results and trends.

Across samples no effects are found on need for recovery of the control variables age and average work week. Overall, the effects pertaining to these variables are small and positive but not significantly different from zero. Interestingly enough, gender is associated with need for recovery in all but the health care and white collar samples. In the education and

blue collar samples, the odds ratios are more or less equal to three, implying that the probability of high need for recovery is larger for women than men. Furthermore, across samples, emotional demands and quantitative demands proved to be the most consistent predictors of need for recovery, whereas effects of physical demands and autonomy were only found in one or two samples.

The results support hypothesis one, though different work demands and different combinations of demands affected need for recovery across samples. The negative effect of autonomy on need for recovery, as posited by hypothesis two, is found as a moderation effect in the health care workers sample and as a significant main effect in the white collar workers sample. Hence, hypothesis two is corroborated to some extent, and furthermore, evidence is provided for the additive hypothesis stating that a worker's need for recovery substantially increases when job characteristics are unfavorable; that is, when work demands are high and autonomy is low (De Raeve et al., 2007; Sluiter et al., 1999; Sonnentag & Zijlstra, 2006).

The results further illustrate the importance of work potential as a determinant in the work procedure. Across all samples, chronic illness positively affected need for recovery. More specifically, a clear trend emerged in which the magnitude of the positive effect on need for recovery relates in an ordinal fashion to the degree of chronic illness (healthy, ill, and co-morbid). Apart from main effects of chronic illness, a moderation effect is found in the health care workers sample, providing some, albeit meager, support for hypothesis four.

Consequences of Need for Recovery

To examine whether need for recovery is associated with illness-related absenteeism and work-related injuries, we apply Baron and Kenny's (1986) four-step mediation framework in the context of logistic regression modeling. The framework's four steps are depicted by figure 2.

Insert figure 2 about here

In figure 2, M stands for mediator, X denotes one (or more) independent variable(s), and Y denotes one (or more) dependent variable(s). Step 1 entails the regression of one (or more) dependent variable(s) on one (or more) independent variable(s), which according to the framework should result in significant relationships. We skip this step because non-significant outcomes can be misleading in the sense that direct and indirect effects may cancel each other out (see James, Mulaik, & Brett, 2006). Step 2 concerns the regression of the mediator on one or more independent variables. Step 2 was already completed in the previous analyses, where need for recovery (the presumed mediator) was regressed on multiple variables.

In the remaining part of this paper, we complete Step 3; that is, regress each of the load consequences' indicators (i.e., illness-related absenteeism and work-related injuries) on need for recovery, and complete Step 4 by regressing each of these indicators on need for recovery but also on the significant predictors of need for recovery identified in the previous analyses. If need for recovery mediates the relationship between on the one hand work demands and autonomy, and on the other hand the indicators, a significant effect should emerge in Step 3 and remain significant in Step 4. Both steps are conducted for each sample separately.

The health care workers sample.

Table 6 shows the results of the mediation analysis for illness-related absenteeism and work-related injuries. The probabilities modeled in the analyses in all samples are reported absent (one or more times) and experienced (one or more) injuries. The table provides the results of Step 3 and Step 4, and in the latter step variables are included that proved significant predictors of need for recovery in the previous analyses (see table 5). Need for recovery is positively associated with illness-related absenteeism (b = .68,

$\chi^2(1) = 15.3, p < .001)$ and work-related injuries (b = .54, $\chi^2(1) = 5.41, p = .02$). Important to note is that need for recovery only explains 3% of the variance in absenteeism and 1% of the variance in work injuries.

Insert table 6 about here

Table 6 further shows that by adding the significant predictors of need for recovery to the analyses, the effect of need for recovery on absenteeism (b = .38, $\chi^2(1) = 3.95, p = .04$) decreases, yet remains significant. However, with respect to work-related injuries, the effect of need for recovery becomes non significant (b = .13, $\chi^2(1) = .23, p = .64$), the implication of which is that need for recovery does not act as a mediator with respect to work-related injuries. Hypothesis three is only supported with respect to illness-related absenteeism in the health care workers sample.

The education workers sample.

Table 7 shows the results of the mediation analysis for the education workers sample. Need for recovery is positively associated with illness-related absenteeism (b = .92, $\chi^2(1) = 14.3, p < .001$), explaining roughly 6% of the variance in absenteeism, but not with work-related injuries (b = .41, $\chi^2(1) = 1.03, p = .31$). After adding variables in Step 4, the positive association between need for recovery and illness-related absenteeism does not change much and remains significant (b = .93, $\chi^2(1) = 10.36, p < .001$), which indicates that need for recovery acts as a mediator with respect to absenteeism, thereby partially confirming hypothesis three.

Insert table 7 about here

The blue collar workers sample.

Table 8 shows the results of the mediation analysis for the blue collar workers. Need for recovery is positively associated with illness-related absenteeism (b = .59, $\chi^2(1) = 24.7, p < .001$) and work-related injuries (b = 1.0, $\chi^2(1) = 39.7, p < .001$). Important to note is that need for recovery only explains 2% of the variance in absenteeism and 5% of the variance in work-related injuries. After adding variables in Step 4, the effects of need for recovery somewhat decrease but remain significant. The results of the analyses provide evidence that need for recovery acts as a mediator with respect to absenteeism and work injuries in the blue collar sample, thereby corroborating hypothesis three.

Insert table 8 about here

The white collar workers sample.

Table 9 shows the results of the mediation analysis for the sample composed of white collar workers. In Step 3, the results show that need for recovery is positively associated with illness-related absenteeism (b = .78, $\chi^2(1) = 65.58, p < .001$) and work-related injuries (b = 1.12, $\chi^2(1) = 23.96, p < .001$). However, the effect sizes, in terms of explained variances, are small, only 4% of the variance in absenteeism and work injuries is accounted for by need for recovery. The effect of need for recovery on illness-related absenteeism decreases after adding variables in Step 4 (b = .65, $\chi^2(1) = 37.53, p < .001$), but remains significant. The effect of need for recovery on work-related injuries decreases after adding variables and becomes non significant (b = .48, $\chi^2(1) = 3.59, p = .06$). As a result, no evidence is found in favor of need for recovery as a mediator regarding work-related injuries. Hence, in this sample, hypothesis three is only supported with respect to absenteeism.

Insert table 9 about here

Summary of need for recovery's mediating role.

Overall, evidence is found of a mediating role of need for recovery with respect to illness-related absenteeism. Though the statistically significant results clearly point into the direction of mediation, the effect sizes are small across samples; that is, the proportions explained variance range from two to six percent. A plausible explanation for these small effect sizes is the multi-factorial etiology of absenteeism (cf. Alexanderson, 1998). In this study, we purposefully focused on absenteeism due to sickness, yet still there are many other causes, next to mental and physical impairment due to insufficient recovery, that may prevent an employee showing up for work (e.g., contracting the flu, breaking a leg, and so on).

Less evidence is found for a mediating role of need for recovery with respect to work-related injuries. In the health care, the education, and the white collar samples no statistically significant effects are found indicating a mediating role of need for recovery. One straightforward explanation is that work-related injuries in these samples, particularly in the education and white collar samples, do not occur that often, and if they do, are likely to result from causes different than prolonged insufficient recovery. The work environments of education and white collar workers are, give or take a few exceptions, not risky nor hazardous; so, it is perhaps unlikely to assume that these employees are at risk to suffer from an injury caused by work-induced fatigue.

How different is the situation for blue collar workers. Significant results are found in this sample, corroborating the mediating role of need for recovery. Blue collar workers are involved in manual labor in, for instance, construction, manufacturing or maintenance, and as such are far more likely to be exposed to environments that are risky and hazardous. In these type of environments, work-induced fatigue may cause accidents because it compromises an

individual's ability to process information quickly and to respond effectively (Swaen et al., 2003). The effect size is again small (5%), which is probably due to the multi-causal nature of work-related injuries; that is, work-induced fatigue is just one of many potential causes of occupational accidents.

Relationships between chronic illness and load consequences.

Hitherto we have considered the mediating role of need for recovery with respect to illness-related absenteeism and work-related injuries. Further of interest is to examine whether chronic illness is associated with these variables, and in particular, if it moderates the relationships between need for recovery on the one hand and absenteeism and work injuries on the other hand. If moderation effects emerge, in the sense that chronic illness strengthens the relationships between need for recovery and load consequences, it would be indicative of a faster accumulation process in the chronically ill, as posited by hypothesis five.

Using the Step 4 logistic regression results from table six through nine, chronic illness is positively associated with absenteeism in the blue collar workers sample, $\chi^2(2) = 43.45, p < .001,$ with the odds of illness-related absence 2.39 times larger for chronically ill workers compared to healthy workers, and the odds of absence 1.79 times larger for the chronically ill compared to the chronically ill with co-morbidity $(b = .87 - .29 = .58, \chi^2(1) = 10.37, p < .001)$. Furthermore, a positive association is found in the white collar workers sample, $\chi^2(2) = 39.66, p < .001,$ with the odds of absence 1.79 times larger for the chronically ill and 1.57 times larger for the chronically ill with co-morbidity, compared to the healthy worker. However, there is no significant difference between the chronically ill and the chronically ill with co-morbidity on the probability of illness-related absence $(b = .58 - .45 = .13, \chi^2(1) = .83, p = .36)$. The association is not significant in the health care workers sample, $\chi^2(2) = 5.13, p = .08,$ and the education workers sample,

$\chi^2(2) = 1.04, p = .59,$ producing a mixed picture with respect to the relationship between chronic illness and absenteeism.

Chronic illness is positively associated with work injuries in the white collar sample, $\chi^2(2) = 17.54, p < .001,$ where the odds of work-related injuries are 2.9 times larger for the chronically ill and 2.8 times larger for the chronically ill with co-morbidity, compared to healthy workers. The odds ratio, comparing the chronically ill to the chronically ill with co-morbidity, does not differ significantly from one $(b = 1.06 - 1.03 = .03, \chi^2(1) = .01, p = .92).$ The association is not significant in the health care workers, $\chi^2(2) = 2.46, p = .29,$ the education workers, $\chi^2(2) = 2.95, p = .23,$ and the blue collar workers samples, $\chi^2(2) = 2.83, p = .24.$ Thus, the association between chronic illness and work-related injuries is only present in the sample of white collar workers.

To test whether chronic illness moderates the relationships between need for recovery and the different indicators of load consequences, we use G^2 in a conditional test procedure where each Step 4 model for each outcome and sample (M_{Step4}) is tested against an elaborated version of the model that includes the interaction effect between chronic illness and need for recovery (M_{Step4+}). Table 10 shows that none of the conditional tests leads to a significant result, indicating that the extended model (M_{Step4+}), which includes the moderation effect, does not do a better job predicting any of the indicators across the samples than the more restricted model (M_{Step4}).

Insert table 10 about here

As a result, we find no evidence supporting the hypothesized role of chronic illness as moderating the relationships between need for recovery and illness-related absenteeism and

work-related injuries. This implies that there is no ground to assume that the accumulation process differs between healthy workers, chronically ill workers, and chronically ill workers with co-morbidity. With respect to hypothesis five, positive main effects of chronic illness are found on absenteeism in the blue collar and white collar samples, and on work-related injuries in the white collar sample.

Discussion

In this study, the effort-recovery model was empirically tested in four occupation-stratified samples (health care, education, blue collar, and white collar workers). More specifically, the study's threefold aim was to examine: a) whether need for recovery mediates the relationship between on the one hand work demands – quantitative, emotional, and physical demands – and autonomy, and on the other hand outcomes indicative of load consequences (i.e., illness-related absenteeism and work-related injuries), b) if this mediation relationship is stronger for chronically ill workers compared to healthy workers, and c) whether these relationships are consistently present across the different samples.

In line with the literature, quantitative demands (e.g., De Croon et al., 2004; Eriksen et al., 2006; Van Veldhoven & Broersen, 2003) and emotional demands (e.g., Sluiter et al., 2003) are the most consistent predictors of need for recovery across samples. Less consistent effects are found for physical demands; that is, only a (small) positive effect on need for recovery in the sample of white collar workers. The latter might be due to the fact that during the past decades extensive legislation has been developed (i.e., the working conditions act or 'ARBO-wet') in the Netherlands to ensure and improve workers' safety, health, and well-being (Rijksoverheid, 2012b). Part of the legislation concerns recommendations on how to arrange the work environment, safety rules for machine handling, and regulations to facilitate heavy work (e.g., how to carry or lift heavy loads and limits on physical loads). This may

explain why anticipated effects of physical demands on need for recovery, particularly in the blue collar workers and health care workers samples, did not materialize.

A mediating role of need for recovery regarding illness-related absenteeism was present in all samples, which aligns with earlier findings (De Croon et al., 2003; Sluiter et al., 2003; Van Veldhoven, 1996). In the blue collar workers sample, need for recovery also acted as a mediator with respect to work-related injuries, which is in line with a study conducted by Swaen et al. (2003), who showed that work-induced fatigue is a prospective risk factor for suffering from an occupational accident. However, Swaen et al. (2003) used a heterogeneous sample of workers, holding different jobs in various types of organizations, while in this study the mediating effect only emerged in the blue collar workers sample, which suggests that the relationship between need for recovery and work-related injuries is stronger in more risky and hazardous work environments.

Less support is found for chronic illness as moderating the mediation relationship, positing that the effects of work demands and autonomy on need for recovery, and the effects of need for recovery on load consequences are stronger for the chronically ill. That is to say, the only moderation effect of chronic illness is present in the health care workers sample, where it moderates the relationship between autonomy and need for recovery. The moderation effect is in the proposed direction, suggesting that autonomy – the ability to regulate effort investment (Jackson et al., 1993) – is more important for chronically ill than healthy workers. In combination with the significant negative effect of autonomy on need for recovery found in the white collar sample, it corroborates the additive hypothesis stating that a worker's need for recovery decreases when work demands are low and autonomy is high (De Raeve et al., 2007; Sluiter et al., 1999; Sonnentag & Zijlstra, 2006).

This study provided no evidence in favor of chronic illness moderating the relationships between work demands and need for recovery, suggesting that the occupational

stressors considered do not affect the chronically ill differently than healthy workers. An alternative explanation for the absence of moderation effects might be that chronically ill workers are entitled to, or have negotiated, specific work arrangements and, as a result, their initial working conditions differ from those of healthy workers. Furthermore, the chronically ill workers under study are the 'survivors'; that is to say, those who managed to keep their jobs despite their medical condition. One might conjecture that this particular group of workers is made up of mentally tough individuals who, compared to chronically ill workers who dropped out of active jobs, tend to perceive working conditions as less stress provoking. An interesting research endeavor would be to examine whether 'survivors' differ on personality characteristics, like perseverance or self-efficacy, from 'dropouts'.

Also no moderation effects are found of chronic illness on the relationships between need for recovery and illness-related absenteeism and work-related injuries. This suggests that the pace of the accumulation process (Kompier, 1988) is not influenced by the worker's health status. This finding is in contradiction with previous research, which showed that the recovery process after work – or unwinding – is influenced by workers' characteristics (e.g., health status; Galambos & Walters, 1992). One explanation for not finding moderation effects might be that a crucial link in the causal chain of events is missing; namely, recovery potential. As a person characteristic, recovery potential can be conceived of as the time needed for an individual to return to pre-stressor functioning after the exposure to the stressor(s) is terminated (Craig & Cooper, 1992). It is unlikely that there is a one-to-one relationship between suffering from chronic illness(es) and recovery potential, and for all we know the relationship may take different forms for different types of chronic diseases.

Though the moderating role of chronic illness proved limited, this study clearly demonstrates the need for considering work potential when investigating the effort-recovery model. Across samples, chronic illness had a strong positive effect on need for recovery, and

the magnitude of this effect relates ordinally to the degree of chronic illness (i.e., healthy, ill, and co-morbid). This study also showed direct positive effects of chronic illness on absenteeism and work injuries, but the most interesting finding – from a labor market strategy perspective – is the indirect path from chronic illness via need for recovery to absenteeism and work injuries. The chronically ill constitute a vulnerable group, given that they are more prone to experience work-induced fatigue, and as such are more likely to report absent or at risk for being injured in an occupational accident when holding a blue collar job.

To stimulate employability and labor participation of the chronically ill, and to make sure that they stay employed, it is key to address this indirect path and to find ways to reduce its sum effect. One obvious way is to decrease the effects of work demands (i.e., emotional and quantitative demands) on need for recovery by limiting the exposure of the chronically ill to these occupational stressors. It is doubtful, however, whether this is practically feasible. Alternatively, autonomy negatively affects need for recovery, with the effect amplified for the chronically ill. It seems sensible to grant those diagnosed chronically ill more autonomy, but how to implement this in practice much depends on the chronic disease(s) and the occupational sector considered, and clearly awaits further (experimental) research. Important to note is that only autonomy was included in this study, which is one of two dimensions of decision latitude. Future research should also add skill discretion, which can be defined as "the level of skill and creativity required on the job and the flexibility permitted the worker in deciding what skills to employ" (Karasek et al., 1998, p. 323), as to see whether it fulfills a similar (interacting) role as autonomy.

To conclude, Van Veldhoven (2008) recently pointed out that most attention in need for recovery research is devoted to situational characteristics, in particular, the task demands and psychosocial factors in the work environment, and less to person characteristics, which is largely uncharted territory. This study has attempted to shed some light on the latter, and its

main takeaway message is to focus more on worker characteristics, than working conditions, in the context of need for recovery research.

Strengths and Limitations

This study joins the trend to use occupation-stratified samples (De Croon et al., 2002; Kristensen, 1995; Sparks & Cooper, 1999). Follow-up analyses showed that the results derived from the four occupation-stratified samples largely overlap with findings that result from performing the same analyses on the four samples combined. However, a clear advantage of the multi-sample set-up is that it permits testing the generalization of the effort-recovery model across occupation-stratified samples. Furthermore, sample-specific effects are found that do not appear when analyzing the complete sample. For example, the moderation effect of chronic illness on the relationship between autonomy and need for recovery in the health care workers sample, or the mediation effect of need for recovery with respect to work-related injuries in the blue collar workers sample.

A limitation of the present study is that all the dependent, as well as the independent, variables are adapted or derived from a self-completed questionnaire (i.e., NCWS). As a result, unmeasured self-report bias – for instance, negative affectivity or social desirability – may have amplified the relationships among the variables considered. Furthermore, the data from the NCWS are cross-sectional, which precludes any strong causal inference.

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Footnotes

[1] For this study the data from the Netherlands Working Conditions Survey 2003, originated and owned by TNO, are used. The content of this thesis is the full responsibility of the author.

Table 1

Cronbach Alphas Reported for each Scale per Sample

	Health care workers	Education workers	Blue collar workers	White collar workers
Autonomy	.81	.83	.84	.87
Quantitative demands	.88	.88	.86	.88
Physical demands	.91	.86	.92	.86
Emotional demands	.81	.79	.77	.73
Need for recovery after work	.87	.87	.89	.87

Table 2

Descriptives of the Four Samples of Workers Under Study

	Health care workers (N=933)		Education workers (N=350)		Blue collar workers (N=1836)		White collar workers (N=2934)	
Variables	Mean (SD)	%	Mean (SD)	%	Mean (SD)	%	Mean (SD)	%
Work demands / Control								
Quantitative	2.32 (.46)		2.43 (.44)		2.26 (.45)		2.21 (.47)	
Physical	2.04 (.62)		1.54 (.41)		2.43 (.65)		1.78 (.49)	
Emotional	2.20 (.45)		2.17 (.41)		1.56 (.40)		1.72 (.40)	
Autonomy	2.71 (.58)		2.81 (.52)		2.67 (.70)		2.88 (.67)	
Need for recovery (High / Low)		28.1 / 71.9		42.2 / 57.8		25.1 / 74.9		26.2 / 73.8
Chronic illness (Healthy / Ill / Co-morbid)		59.4 / 26.6 / 14		58.3 / 26 / 15.7		64.1 / 21.3 / 14.6		62.3 / 24.1 / 13.6
Illness-related absenteeism (Yes / No)		60.6 / 39.4		59.1 / 40.9		50.5 / 49.5		56.6 / 43.4
Work-related injuries (Yes / No)		10.1 / 89.9		8.4 / 91.6		11.5 / 88.5		3.3 / 96.7
Gender (Male / Female)		15.5 / 84.5		42 / 58		90.1 / 9.9		40.2 / 59.8
Age (years)	37.5 (10.9)		41.4 (11.3)		40.2 (11)		35.9 (11.5)	
Average work week (hours)	25.2 (10.1)		31.2 (9.4)		36.5 (8.2)		29.2 (11.3)	

Table 3

Specification of Five Logit Models

Variables	Model				
	M_1	M_2	M_3	M_4	M_5
Work demands / Control					
Quantitative	x	x	x	x	x
Physical	x	x	x	x	x
Emotional	x	x	x	x	x
Autonomy	x	x	x	x	x
Work potential					
Ill	x	x	x	x	x
Co-morbid	x	x	x	x	x
Controls					
Gender (Male)	x	x	x	x	x
Age	x	x	x	x	x
Average work week	x	x	x	x	x
Moderator effects					
Quantitative x Ill		x			
Quantitative x Co-morbid		x			
Physical x Ill			x		
Physical x Co-morbid			x		
Emotional x Ill				x	
Emotional x Co-morbid				x	
Autonomy x Ill					x
Autonomy x Co-morbid					x

Table 4

Fitting Five Logistic Regression Models

	Health care workers		Education workers		Blue collar workers		White collar workers	
Model	$G^2(M_l \mid M_S)$	R^2	$G^2(M_l \mid M_S)$	R^2	$G^2(M_l \mid M_S)$	R^2	$G^2(M_l \mid M_S)$	R^2
M_1	769.6	.27	310.3	.36	1356.4	.30	2502.6	.25
M_2	767.6	.28	310.3	.36	1355.4	.30	2498.1	.26
M_3	767.2	.28	306.1	.38	1354.4	.30	2496.6	.26
M_4	761.6	.29	308.1	.37	1353.4	.30	2502.0	.25
M_5	760.1	.29	308.4	.37	1352.6	.30	2500.9	.26

Note: R^2 stands for Nagelkerke's pseudo measure of explained variance.

Table 5

Logistic Regression Results

	Health care workers		Education workers		Blue collar workers		White collar workers	
	M_5		M_1		M_1		M_1	
Variables	b (SE)	OR	b (SE)	OR	b (SE)	OR	b (SE)	OR
Intercept	-8.51	-	-9.94	-	-7.62	-	-6.00	-
Work demands/Control								
Quantitative	1.78 (.24)***	5.93	2.39 (.4)***	10.9	2.0 (.18)***	7.58	1.77 (.12)***	5.86
Physical	.29 (.16)	1.34	.53 (.36)	1.71	.08 (.11)	1.09	.24 (.11)*	1.28
Emotional	.53 (.23)*	1.70	.48 (.37)	1.62	.69 (.18)***	2.00	.83 (.13)***	2.28
Autonomy	.13 (.22)	1.13	.08 (.29)	1.08	-.16 (.10)	.85	-.28 (.08)***	.76
Work potential								
Ill	2.97 (1.02)**	19.4	.75 (.33)*	2.11	.30 (.17)	1.35	.31 (.12)**	1.36
Co-morbid	4.35 (1.3)***	77.6	1.18 (.41)**	3.26	1.07 (.2)***	2.92	.85 (.14)***	2.34
Controls								
Gender	.46 (.27)	1.58	1.14 (.3)***	3.14	1.1 (.24)***	3.01	.12 (.11)	1.13
Age	.003 (.01)	1.00	.008 (.01)	1.01	-.001 (.007)	1.00	-.009 (.005)	.99
Average work week	.01 (.01)	1.01	.01 (.02)	1.01	.015 (.01)	1.02	-.005 (.005)	1.00
Moderator effects								
Autonomy x Ill	-.90 (.38)*	.41						
Autonomy x Co-morbid	-1.18 (.47)*	.31						

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

The p-values apply to the Wald statistic.

Table 6

Results of Mediation Analysis for Health Care Workers

	Illness-related absenteeism		Work-related injuries	
	Step 3	Step 4	Step 3	Step 4
Variables	b (SE)	b (SE)	b (SE)	b (SE)
Intercept	.26	-.60	-2.28	-5.42
Need for recovery	.68 (.17)***	.38 (.19)*	.54 (.23)*	.13 (.27)
Work demands / Control				
Quantitative		.12 (.19)		-.03 (.28)
Emotional		.68 (.19)***		1.43 (.26)***
Autonomy		-.35 (.13)**		-.05 (.21)
Work potential				
Ill		.40 (.18)*		.28 (.27)
Co-morbid		.23 (.23)		.46 (.32)
Nagelkerke's R Square	.03	.08	.01	.10

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

Table 7

Results of Mediation Analysis for Education Workers

	Illness-related absenteeism		Work-related injuries	
	Step 3	Step 4	Step 3	Step 4
Variables	b (SE)	b (SE)	b (SE)	b (SE)
Intercept	-.01	.35	-2.55	-2.90
Need for recovery	.92 (.24)***	.93 (.29)***	.41 (.40)	.28 (.47)
Work demands				
Quantitative		-.34 (.31)		.02 (.51)
Work potential				
Ill		.29 (.29)		.71 (.46)
Co-morbid		.11 (.35)		.71 (.54)
Controls				
Gender		.67 (.24)**		.05 (.42)
Nagelkerke's R Square	.06	.11	.01	.03

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

Table 8

Results of Mediation Analysis for Blue Collar Workers

	Illness-related absenteeism		Work-related injuries	
	Step 3	Step 4	Step 3	Step 4
Variables	b (SE)	b (SE)	b (SE)	b (SE)
Intercept	-.11	-1.10	-2.36	-4.05
Need for recovery	.59 (.12)***	.38 (.14)**	1.0 (.16)***	.66 (.19)***
Work demands				
Quantitative		.29 (.13)*		.46 (.20)*
Emotional		.11 (.14)		.45 (.20)*
Work potential				
Ill		.87 (.13)***		.01 (.20)
Co-morbid		.29 (.15)		.35 (.21)
Controls				
Gender		.04 (.17)		-.57 (.31)
Nagelkerke's R Square	.02	.07	.05	.07

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

Table 9

Results of Mediation Analysis for White Collar Workers

	Illness-related absenteeism		Work-related injuries	
	Step 3	Step 4	Step 3	Step 4
Variables	b (SE)	b (SE)	b (SE)	b (SE)
Intercept	.08	.50	-3.88	-8.52
Need for recovery	.78 (.09)***	.65 (.11)***	1.12 (.23)***	.48 (.25)
Work demands / Control				
Quantitative		.20 (.10)*		.37 (.27)
Physical		-.01 (.09)		.71 (.21)***
Emotional		-.21 (.11)		1.18 (.29)***
Autonomy		-.23 (.06)***		-.03 (.16)
Work potential				
Ill		.58 (.10)***		1.06 (.28)***
Co-morbid		.45 (.13)***		1.03 (.31)***
Nagelkerke's R Square	.04	.07	.04	.13

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

Table 10

Testing for Moderation Effects

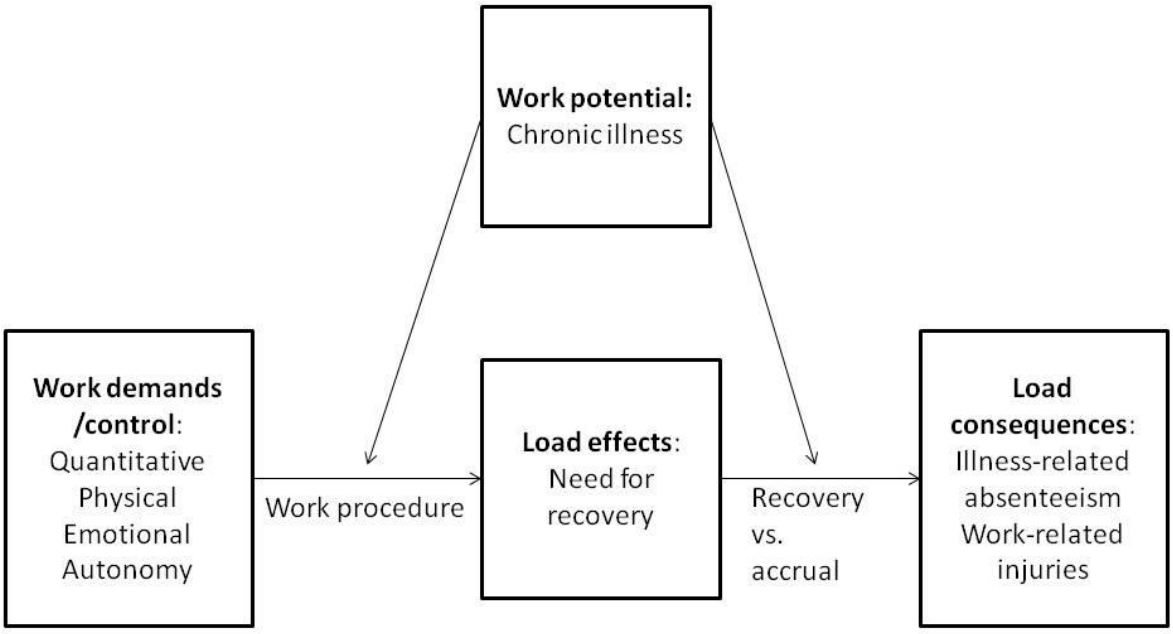
	Health care workers			Education workers			Blue collar workers			White collar workers		
Outcomes	$G^2(M_{Step4} \mid M_{Step4+})$	*df*	*p*	$G^2(M_{Step4} \mid M_{Step4+})$	*df*	*p*	$G^2(M_{Step4} \mid M_{Step4+})$	*df*	*p*	$G^2(M_{Step4} \mid M_{Step4+})$	*df*	*p*
Illness-related absenteeism	3.46	2	.18	1.19	2	.55	.55	2	.76	1.41	2	.49
Work-related injuries	2.00	2	.37	.26	2	.88	.37	2	.83	3.80	2	.15

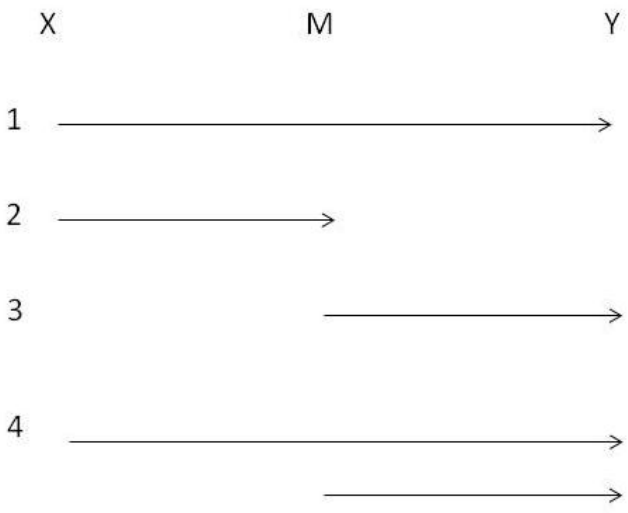
Note: *df* stands for degrees of freedom

Figure Caption

Figure 1. Operationalization of the effort-recovery model (based on Meijman, 1989; Meijman & Mulder, 1998; Van Veldhoven, 1996, 2008)

Figure 2. Baron and Kenny's (1986) mediation model


Work potential:
Chronic illness
Work demands /control:
Quantitative
Physical
Emotional
Autonomy
Work procedure
Load effects:
Need for recovery
Recovery vs. accrual
Load consequences:
Illness-related absenteeism
Work-related injuries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