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Long-term Effects of Psychosocial Work Stress in Midlife on Health Functioning After Labor Market Exit—Results From the GAZEL Study

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Objectives. To study long-term effects of psychosocial work stress in mid-life on health functioning after labor market exit using two established work stress models.

Methods. In the frame of the prospective French Gazel cohort study, data on psychosocial work stress were assessed using the full questionnaires measuring the demand-control-support model (in 1997 and 1999) and the effort–reward imbalance model (in 1998). In 2007, health functioning was assessed, using the Short Form 36 mental and physical component scores. Multivariate regressions were calculated to predict health functioning in 2007, controlling for age, gender, social position, and baseline self-perceived health.

Results. Consistent effects of both work stress models and their single components on mental and physical health functioning during retirement were observed. Effects remained significant after adjustment including baseline self-perceived health. Whereas the predictive power of both work stress models was similar in the case of the physical composite score, in the case of the mental health score, values of model fit were slightly higher for the effort–reward imbalance model (R^2: 0.13) compared with the demand-control model (R^2: 0.11).

Conclusions. Findings underline the importance of working conditions in midlife not only for health in midlife but also for health functioning after labor market exit.

Key Words: Gazel—Health functioning—Long-term effects—Work stress.

RAPID increase in life expectancy at middle ages combined with continued low birth rates promotes population aging in industrialized countries and contributes to the emergence of a new stage of the life course, the so-called "third age" (Laslett, 1996). Maintaining core capabilities and appropriate health functioning during this stage of life is an important goal of public health policy as well as of labor market policy because reduced health and functioning were shown to be associated with early retirement (Lund & Villadsen, 2005). Although evidence on a compression of morbidity in aging societies is still scarce (Kalache, Aboderin, & Hoskins, 2002), there is reason to believe that investments into health-promoting conditions during midlife exert favorable effects on functioning and well-being at later stages of the life course (Berney, Blane, Davey Smith, & Holland, 2000; Power & Kuh, 2006). Given their overriding influence, health-related behaviors are a primary target of such investments (Stringhini et al., 2010). Yet additional determinants of health during midlife deserve attention. Among these, health-adverse work and employment conditions in modern economies are of particular relevance (Schnall, Dobson, & Rosskam, 2009). In recent years, many observational and experimental studies have documented an increased risk of physical or mental illness and of reduced health functioning among people who were exposed to an adverse psychosocial work environment (Bonde, 2008; Cartwright & Cooper, 2009; Kivimaki et al., 2006; Marmot & Wilkinson, 2006; Stansfeld & Candy, 2006). Additionally, an adverse psychosocial work environment was associated with increased risks of early retirement due to disability (Dragano & Schneider, 2011). In a majority of studies, an adverse psychosocial work environment was measured by validated questionnaires measuring work stress in terms of two complementary theoretical models that allow for an identification of specific stressful aspects of the workplace, namely the demand-control-support model and the effort–reward imbalance model.

The former model, developed by Karasek (1979) and extended by Karasek and Theorell (1990) and by Johnson and Hall (1988), identifies stressful work in terms of job task profiles defined by three specific dimensions, (a) the amount of psychological (or psychomental) demands, (b) the degree of control or decision latitude at work, and (c) the degree of social support received from supervisors or coworkers. More specifically, the model posits that jobs with high psychological demands and low levels of decision latitude (low control) are stressful and adversely affect

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health because they limit the experience of autonomy at work, while exerting continued pressure. This combination is labeled "high job strain." Moreover, the model assumes that lack or low level of social support at work increases the burden of stressful work and its adverse effects on health.

"Effort–reward imbalance" was developed as a complementary model (Siegrist, 1996) with a focus on the work contract and the principle of social reciprocity lying at its core. Social reciprocity defines distinct obligations to be performed in exchange for adequate rewards. These rewards include money, esteem, and career opportunities (job promotion and job security). On this basis, the model claims that lack of reciprocity (high effort in combination with low reward or effort–reward imbalance) generates strong negative emotions and psychobiological stress responses with adverse long-term effects on health. A lack of reciprocity may specifically occur frequently in modern working life, for instance, among employees who have no alternative choice in the labor market or who are exposed to heavy competition. Moreover, this sociological model includes a psychological component termed "overcommitment" that addresses the intrinsic motivational source of high effort, in addition to the above-mentioned extrinsic source. Thus, people who are strongly overcommitted to their work while experiencing effort–reward imbalance are at excess risk of developing a stress-related disorder.

Taken together, both work stress models cover different but equally relevant aspects of the workplace, where lack of autonomy (high demand and low control, "job strain") and frustration of legitimate rewards (imbalance between high efforts and low rewards, effort–reward imbalance) matter most. Although these combinations delineate the essence of stressful experience at work, each single component of the two models may contribute to the overall risk. Therefore, in our analysis, we will analyze effects on health functioning that are due to the combined measures as well as those that are due to their single components (see below).

Several prospective observational investigations analyzed the effects of stressful work in terms of these two models with an emphasis on health functioning as an outcome (Cheng, Kawachi, Coakley, Schwartz, & Colditz, 2000; Kuper, Singh-Manoux, Siegrist, & Marmot, 2002; Stansfeld, Bosma, Heminway, & Marmot, 1998), but their findings were related to populations whose majority was still employed at the time of assessing health functioning. To our knowledge, no study has yet explored long-term effects of an adverse psychosocial work environment with a focus on health functioning after labor market exit as an outcome.

In this study, we set out to fill this gap by linking data on stressful work, in terms these two models, obtained from screenings conducted between 1997 and 1999 in the frame of the French GAZEL cohort, with data on health functioning obtained in 2007, a time when almost all respondents had left the labor market. More specifically, we test the hypothesis that employees who experienced a high level of stressful work in terms of the two models are at elevated risk of experiencing poor mental and physical health functioning after labor market exit compared with their less exposed colleagues. We test this hypothesis with respect to the two combined measures of work stress, their single scales as well as distinct interaction terms between scales. Given the strong and enduring endogenous effects of poor health in midlife on functioning and well-being later, available information on health at the time of work stress assessment needs to be included in respective analyses (Breeze et al., 2001).

In addition to this first aim, a second aim of this contribution concerns the methodology of assessing an adverse psychosocial work environment. As the GAZEL study protocol includes the full original versions of the Job Content Questionnaire (JCQ) measuring the demand-control-support model (applied in 1997 and 1999; Karasek et al., 1998) and of the effort–reward imbalance questionnaire (applied in 1998; Siegrist et al., 2004), we are given the opportunity to analyze (a) the interrelations of all single scales and the effects of single and combined scales of each model on health functioning and of analyzing and (b) the combined effects of the two models, adjusted for each other, and two theoretical assumptions of effect modifications (high job strain and low social support; effort–reward imbalance and high overcommitment). Moreover, using measures of model fit, the statistical power of each work stress model of predicting health functioning later on can be compared. Although several previous studies explored the separate and combined effects of scales measuring, these two work stress models (Calnan, Wadsworth, May, Smith, & Wainwright, 2004; de Jonge, Bosma, Peter, & Siegrist, 2000; Ostry, Kelly, Demers, Mustard, & Hertzman, 2003; Rydstedt, Devereux, Sverke, 2007), to our knowledge, no investigation has yet analyzed all steps mentioned above within the frame of a prospective study design analyzing long-term effects of work stress in mid-life on health functioning after labor market exit.

Methods

Study Population

Data were obtained from the GAZEL cohort study (M. Goldberg et al., 2007) initiated in 1989 among employees of the French National Electricity and Gas Company (EDF-GDF). Since study onset, a self-administered questionnaire has been sent annually to the participants. Information on work stress was obtained among respondents who were still employed between 1997 and 1999 (see measurement for details). Data on our health outcome were measured in 2007, where the majority of the participants were retired (90%). For all years, response rates ranges from 75% to 72%, with a sample largely constituted by the same participants throughout the years (over 90 percent). In our analyses, we were interested in work stress and its long-term effect on health functioning after labor market exit. Therefore, we restricted our sample to all men and women who were employed between 1997 and

1999 and who were retired in 2007. This restriction results in a longitudinal sample with complete information on all variables of 6,053 men and women. Although the GAZEL cohort represents a specific employment sector, the study population was recruited from urban and rural areas throughout France, representing a wide range of occupations and a socioeconomic structure that is well-comparable to the French population, for example, in terms of educational attainment (for a detailed cohort profile see M. Goldberg et al., 2007).

Measures

Psychosocial working conditions.—In the GAZEL study, both work stress models mentioned above were measured using the full original questionnaires, that is, the JCQ measuring the demand-control-support model and the effort–reward imbalance questionnaire (ERI-Q). By collecting full data of these models, we are in a position to analyze all scales of either work stress models including their subscales and to compare separate and combined effects on health functioning. While the effort–reward imbalance questionnaire was assessed only once, in 1998, the JCQ was incorporated twice, in 1997 and 1999. For the analyses, information of the JCQ from 1997 to 1999 was combined to one measure of 1998, where the mean value of both years was calculated. To increase sample size, information for one single year was used if values were available once only. With the proposed strategy of analyses of respective scales, we followed the procedure of a previous paper by Sembajwe and colleagues (2011), where basic test-statistical information is given. Moreover, the psychometric properties of both questionnaires were previously tested for the Gazel study (Niedhammer, 2002; Niedhammer, Siegrist, Landre, Goldberg, & Leclerc, 2000).

The JCQ (measuring the demand-control-support model) consists of 31 items measuring four scales: decision latitude (9 items), psychological demands (9 items), social support (8 items), and physical demands (5 items). Although this latter dimension is not a core part of the theoretical model, we nevertheless included this dimension into the analyses in order to make full use of the JCQ questionnaire. Each item was answered on a 4-point scale (ranging from "totally disagree" to "totally agree"). Sum scores were created for each of the scales according to existing recommendations (Karasek et al., 1998). In the case of decision latitude and social support, the respective subscales were created (decision latitude: skill discretion [6 items] and decision authority [3 items]; social support: supervisor support and coworker support [each 4 items]). Moreover, for each scale and subscale, binary indicators were created using respective tertiles (upper or lower) to identify poor working conditions as well as a binary indicator was created to identify jobs with "high demand" and "low control" (job strain).

The ERI-Q (measuring the effort–reward imbalance model) consists of 23 items and three scales, "effort" (6 items), "reward" (11 items), and "overcommitment" (6 items). All effort and reward items were rated on a 5-point scale, which was answered in two steps. First, respondents were asked whether the items applied, and second—if so—to what extent they felt distressed about it (ranging from "not distressed" to "very distressed"). Statements of overcommitment were rated on a 4-point scale (ranging from "totally disagree" to "totally agree"). Once more, we followed established procedures (Siegrist et al., 2004) and calculated sum scores for each dimension of the model including the three theoretically relevant subscales of reward (esteem [5 items], job promotion [4 items], and job security [2 items]). Next, binary indicators were created for each scale and subscale using upper or lower tertile of the respective scale to measure poor quality of work. Importantly, in order to quantify the degree of mismatch between effort and reward at individual level, the ratio of the scores of the effort and reward scales was calculated (adjusted for number of items) with higher values representing higher levels of stressful work, and the upper tertile was used to identify poor working conditions.

In sum, the measurement approach described above results in seven main scales for both work stress model, seven subscales (see Table 1), and additionally, two summary measures (high job strain; effort–reward imbalance). Thus, a total of 16 binary indicators of poor quality of work are available that were computed in a highly comparable way, based on the original questionnaires.

Health functioning—the Short Form 36 questionnaire.—As main health outcomes, we used two measures of health functioning based on the French standard version of the Short Form 36 Health Survey (SF-36), the mental and physical composite scores (Leplège, Ecosse, Pouchot, Coste, & Pernegger, 2001). The SF-36 questionnaire is an internationally validated measure of health functioning that is based on 36 questions assessing eight specific domains of physical and mental health (Ware & Sherbourne, 1992). The domains related to the physical composite score are physical functioning, role limitations due to physical problems, bodily pain, and general health perception social functioning, and those for the mental composite score are vitality, social functioning, role limitations due to emotional problems, and mental health. The internal consistency of the single domains proved satisfactory in our sample (respective Cronbach's alpha vary between .73 and .94), and two composite scores are derived, a mental composite score (SF-36 MCS) and a physical composite score (SF-36 PCS), both ranging from 0 to 100 with higher scores indicating better health. The psychometric properties of the French SF-36 and the construction of the two scores are fully described elsewhere (Leplège et al., 2001). In order to include maximum information on health functioning in the analyses, continuous data of the two scores were used.

Additional measures.—We included a number of additional sociodemographic measures that mainly served as confounders

Table 1. Description of Measures and Sample (N = 6,053)

Variable (year)	Categories or range	% or mean	N
Gender	Male	83.1	5,030
	Female	16.9	1,023
Age (2007)	54–68 years	62.5	6,053
Educational level (1989)	University	18.8	1,135
	Vocational training	54.0	3,270
	Upper secondary education	7.2	435
	Lower secondary education	20.0	1,213
Occupational category (1998)	Senior executive	39.8	2,410
	Middle executive	51.8	3,133
	Employee	3.5	212
	Worker	4.9	298
Poor self-perceived health (1998)	No	63.7	3,857
	Yes	36.3	2,196
SF-36 MCS (2007)	6.1–71.3	49.1	6,053
SF-36 PCS (2007)	13.6–68.9	50.3	6,053
Job content questionnaire			
Psychological demands (1998)	9–36	22.7	6,053
Decision latitude (1998)	24–96	72.5	6,053
Skill discretion	12–48	35.4	6,053
Decision authority	12–48	37.1	6,053
Social support at work (1998)	8–32	22.0	6,053
Supervisor support	4–16	10.2	6,053
Coworker support	4–16	11.8	6,053
Physical demands (1998)	5–20	7.7	6,053
Effort-reward imbalance questionnaire			
Effort (1998)	6–30	12.9	6,053
Reward (1998)	11–55	46.6	6,053
Esteem	5–25	21.7	6,053
Job promotion	4–20	15.9	6,053
Job security	2–10	8.9	6,053
Overcommitment (1998)	6–24	3.6	6,053

in multivariate models. In addition to age and gender, two indicators of social position (educational level and occupational position) were included to minimize the risk that the observed association between work stress and functional health is mainly due to respondents' social position. Moreover, baseline health based on respondents' self-perceived health was included to adjust for its effect on prospective health functioning. In more detail, the measurements were as follows: Self-rated health was assessed by the following question: "How do you rate your general health status?" Response categories ranged from "very good" (coded 1) to "very poor" (coded 8). This item was previously shown to be strongly associated with physical disease in the GAZEL cohort (P. Goldberg, Gueguen, Schmaus, Nakache, & Goldberg, 2001). For our analyses, participants with answers ranging from 5 to 8 were classified to exhibit poor health. Educational level was assessed by the highest educational degree categorized into four groups (university, vocational training, upper secondary education, upper secondary education). Occupational position refers to respondents' occupation in 1998 and was coded in four categories (senior executive and professional, middle executive, employee, and worker) according to INSEE (French national institute of economic and statistical information; Desrosières & Thévenot, 2002).

Statistical Analysis

First, descriptive analyses were used to explore sample characteristics (Table 1). Second, we studied interrelations between the different scales and subscales of the two work stress models and tested the consistency of the different scales. To do so, correlation coefficients and Cronbach's alpha were computed for each scale and subscale of the demand-control-support model and the effort–reward imbalance model (table 2). Next, to test long-term effects of poor quality of work on health and to test the predictive power of the different scales of work stress, a set of linear regression models (OLS) were calculated using the two SF-36 composite scores as outcomes and the binary indicators of poor quality of work as main covariates (Tables 3 and 4). In the tables, we present regression coefficients (unstandardized coefficient denoted as "ß" and standardized beta coefficient denoted as "Beta") and measures of model fit (coefficient of determination "R^2" as a measure of "explained variance"). While the regression coefficients allow testing for significant effects of the scale, comparisons between their predictive powers should rather be based on the respective model fit. Importantly, to allow these comparisons, all models and their model fit were calculated with the same sample and include the same control variables. In sum, we present estimates of three types of regression models, all adjusted for age, gender, the two indicators of social position (included as categorical variables broken down into dummy variables) and baseline self-perceived health. First, in Model 1, the effect of poor quality of work was calculated for each scale separately (resulting in one regression analysis for each single scale). These models allow for testing the effect of each scale of the demand-control-support model and of the effort–reward imbalance model separately, and to compare their explanatory power based on the model fits. Second, to study the joint effect of the scales of the demand-control-support model and of the effort–reward imbalance model on health functioning, Models 2a and 2b estimate the simultaneous effect of the core dimensions of each respective work stress model. Subscales were excluded in these models due to multicollinearity. By looking at the fit of these models, on the one hand, the predictive power of the two full work stress models was contrasted with the model fit of each single scale (calculated in Model 1), and on the other hand, the predictive power of the demand-control-support model and the effort–reward imbalance model was compared. Finally, in Model 3, the combined effects of all scales of both work stress models were analyzed simultaneously. By doing so, this model allowed to test which of the scales remained important when each single scales of both work stress models were considered and to invest the explanatory

Table 2. Cronbach's α and Intercorrelations of Work Stress Scales and Subscales: All Correlations Except Two are Significant at $p < .001$ ($N = 6{,}053$)

	Items no.	α	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Psychological demands	9	0.80	1.00													
2. Decision latitude	9	0.81	0.12	1.00												
3. Skill discretion	6	0.72	0.23	0.88	1.00											
4. Decision authority	3	0.70	0.01	0.92	0.62	1.00										
5. Social support at work	8	0.82	−0.16	0.38	0.32	0.35	1.00									
6. Supervisor support	4	0.88	−0.17	0.34	0.28	0.32	0.89	1.00								
7. Coworker support	4	0.79	−0.08	0.26	0.24	0.23	0.71	0.31	1.00							
8. Physical demands	5	0.88	0.06	−0.21	−0.16	−0.22	−0.09	−0.09	−0.03	1.00						
9. Effort	6	0.75	0.52	0.12	0.19	0.05	−0.09	−0.08	−0.07	0.08	1.00					
10. Reward	11	0.86	−0.25	0.25	0.17	0.27	0.45	0.44	0.26	−0.18	−0.29	1.00				
11. Esteem	5	0.81	−0.24	0.22	0.14	0.24	0.48	0.46	0.30	−0.13	−0.26	0.90	1.00			
12. Job promotion	4	0.78	−0.18	0.22	0.16	0.23	0.33	0.33	0.18	−0.18	−0.23	0.87	0.63	1.00		
13. Job security	2	0.32	−0.17	0.16	0.12	0.17	0.21	0.22	0.10	−0.12	−0.23	0.60	0.41	0.39	1.00	
14. Overcommitment	6	0.79	0.44	0.14	0.18	0.08	−0.06	−0.02[a]	−0.09	−0.01[a]	0.52	−0.19	−0.17	−0.13	−0.18	1.00

Note. [a]Not significant.

power when both models are analyzed simultaneously. As a last step of the analysis, in Table 5, the effect modification of job strain by social support and of effort–reward imbalance by overcommitment was analyzed. More specifically, we tested whether interactions between the respective scales were statistically significant. For all regression analyses, traditional model diagnostic was applied based on residual analysis. All calculations were done using STATA 11.

Results

Sample Description

In our sample, 79% of the participants were men (Table 1). In 2007—the year when our health outcomes were measured—the age range was 54–68 years with a mean age of 63. With respect to education and occupation, a majority of men and women had a vocational training diploma (54.5%) and were either senior executives or middle executives. The mean scores of all work stress scales correspond to the values observed in earlier studies (Niedhammer, 2002; Niedhammer et al., 2000; Sembajwe et al., 2011). Most of the respondents (92%) were retired for 4 years or longer (results not shown). Furthermore, with respect to the variations of work stress in our sample, we found higher values of the scale "decision latitude" for men compared with women. Moreover, a clear age gradient in quality of work was observed, with better values among older people (particularly for lower psychological demands, more control at work, and more reward in older ages). In addition, quality of work was found to be socially graded, with better quality of

Table 3. Long-term Effects of Work Stress on Mental Health Functioning: Results of a Set of Linear Regression Models ($N = 6{,}053$)

	Model 1: Adjusted bivariate			Model 2a: Demand-control-support only			Model 2b: Effort–reward imbalance only			Model 3: Combined model		
	ß	Beta	R^2	ß	Beta	R^2	ß	Beta	R^2	ß	Beta	R^2
High psychological demands	−2.14***	−0.11	0.100	−2.04***	−0.10					−0.78**	−0.04	
Low decision latitude	−1.26***	−0.06	0.092	−1.08***	−0.05					−1.27***	−0.06	
Low skill discretion	−0.91***	−0.05	0.091									
Low decision authority	−0.95***	−0.05	0.091									
Low social support at work	−1.67***	−0.09	0.096	−1.17***	−0.06					−0.62*	−0.03	
Low supervisor support	−1.21***	−0.06	0.093									
Low co-worker support	−2.19***	−0.11	0.102									
High Physical demands	−0.92***	−0.04	0.091	−0.78**	−0.04					−0.76**	−0.04	
High Job strain	−2.69***	−0.08	0.095	−0.08	0.00					0.37	0.01	
High effort	−2.81***	−0.14	0.107				−1.17**	−0.06		−1.16**	−0.06	
Low reward	−2.55***	−0.13	0.105				−1.70***	−0.09		−1.35***	−0.07	
Low esteem	−2.20***	−0.12	0.103									
Low job promotion	−1.93***	−0.10	0.098									
Low job security	−2.19***	−0.11	0.101									
High overcommitment	−3.27***	−0.16	0.114				−2.41***	−0.12		−2.37***	−0.12	
Effort–reward imbalance	−2.92***	−0.15	0.111				−0.53	−0.03		−0.32	−0.02	
						0.109			0.130			0.137

Notes. Model 1: adjusted for age, gender, social position, and baseline self-perceived health; Model 2: M1 + other components of the respective work stress model; Model 3: M2 + all other components of the two work stress model.

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 4. Long-term Effects of Work Stress on Physical Health Functioning: Results of a Set of Linear Regression Models (N = 6,053)

	Model 1: Adjusted bivariate			Model 2a: Demand-control-support only			Model 2b: Effort–reward imbalance only			Model 3: Combined model		
	ß	Beta	R^2	ß	Beta	R^2	ß	Beta	R^2	ß	Beta	R^2
High psychological demands	−0.81***	−0.06	0.080	−0.80***	−0.06					−0.55*	−0.04	
Low decision latitude	−0.33	−0.02	0.077	−0.31	−0.02					−0.34	−0.02	
Low skill discretion	−0.24	−0.02	0.077									
Low decision authority	−0.32	−0.02	0.067									
Low social support at work	−0.44*	−0.03	0.078	0.27	−0.02					0.14	−0.01	
Low supervisor support	−0.45*	−0.03	0.078									
Low coworker support	0.39*	−0.03	0.077									
High physical demands	−0.71***	−0.05	0.079	−0.67***	−0.04					−0.65**	−0.04	
High job strain	−0.87**	−0.03	0.078	0.11	0.00					0.19	0.01	
High effort	−0.76***	−0.05	0.079				0.06	0.00		0.01	0.00	
Low reward	−0.61***	−0.04	0.078				−0.21	−0.01		−0.10	−0.01	
Low esteem	−0.65***	−0.05	0.079									
Low job promotion	−0.43***	−0.03	0.078									
Low job security	−1.02***	−0.07	0.081									
High overcommitment	−0.58**	−0.04	0.078				−0.27	−0.02		−0.22	−0.01	
Effort–reward imbalance	−0.96***	−0.07	0.081				−0.73*	−0.05		−0.63*	−0.04	
						0.082			0.081			0.085

Notes. Model 1: adjusted for age, gender, social position, and baseline self-perceived health; Model 2: M1 + other components of the respective work stress model; Model 3: M2 + all other components of the two work stress model.

*$p < .05$. **$p < .01$. ***$p < .001$.

work among people with higher education and among men and women who worked as senior executives or middle executives in 1998 (results not shown).

Correlations Between Work Stress Models and Their Scales

What are the interrelations between the two work stress models and their scales and what are the internal consistencies of the different scales? To answer these questions, Table 2 displays Cronbach's α values for all measures and all Pearson's correlation coefficients between the main scales of both work stress models including their subscales. Cronbach's α values were acceptable for all measures, with except of job security, which includes two items only. Again, findings confirm former analyses (Niedhammer, 2002; Niedhammer et al., 2000; Sembajwe et al., 2011) and show that the JCQ and the ERI-Q are valid and consistent measures of work stress. With regard to the interrelations of the scales, the results are as follows: When comparing the single scales of the demand-control-support model with those of the effort–reward imbalance model, we observed strong associations between psychological demands and efforts. Furthermore, strong associations were found between social support and reward. Regarding correlations within the work stress models, in the case of the demand-control-support model, strongest positive associations were found between decision latitude and social support. In the case of the effort–reward imbalance model, strong associations were found between effort and overcommitment.

Table 5. Interactions and Main Effects of Work Stress Scales on Mental and Physical Health Functioning: Results of a Set of Linear Regression Models (N = 6,053)

	ß	Beta	R^2
SF-36 MCS			
High job strain	−1.62*	−0.05	0.100
Low social support at work	−1.35***	−0.07	
High job strain × Low social support	−0.80	−0.02	
Effort–reward imbalance	−1.92***	−0.10	0.124
High overcommitment	−2.25***	−0.11	
Effort–reward imbalance × High overcommitment	−0.56	−0.02	
SF-36 PCS			
High job strain	−1.24*	−0.05	0.079
Low social support at work	−0.40*	−0.03	
High job strain × Low social support	0.72	0.02	
Effort–reward imbalance	−1.19***	−0.08	0.082
High overcommitment	−0.70*	−0.05	
Effort–reward imbalance × High overcommitment	−0.93*	−0.05	

Notes. All estimates are adjusted for age, gender, social position, and baseline self-perceived health.

*$p < .05$. **$p < .01$. ***$p < .001$.

Long-term Effects of Work Stress on Health Functioning

To test long-term effects of work stress on health functioning, results of regression analyses are presented in Tables 3 and 4. In sum, we present findings of three types of regression models. Whereas Model 1 allows for studying the effect of each scale separately, Models 2a and 2b explore the effects on health functioning attributed to the core scales and the summary measures of the two work stress models, adjusted for each other. Finally, in Model 3, the combined effects on health functioning resulting from a simultaneous analysis of all scales of the two work stress models are estimated.

Here, we briefly describe main findings available from Table 3 (mental composite score) and Table 4 (physical composite score). In Table 3, significant effects of each single work stress scale on mental health functioning are observed, controlling for confounding factors (age, gender, social position, and baseline self-rated health; Model 1). For instance, men and women who experienced high psychological demands in their job (assessed between 1997 and 1999) had a significantly lower mental health score (SF-36 MCS) in 2007, compared with those without high psychological demands. When comparing the different scales of the demand-control-support model, highest coefficients were observed for high psychological demands, low social support (in particular, coworker support) and the summary measure of high job strain.

In the case of the effort-reward-imbalance model, coefficients were relatively highest for the scales “high effort,” “high overcommitment” and the summary measure of effort–reward imbalance, and the explanatory power was somewhat higher compared with the demand-control-support model. In addition, a closer look revealed that the three single scales of the effort–reward imbalance model (high effort, high overcommitment, and effort–reward imbalance) contribute most strongly to the explanatory power if compared with a model where control variables only are included (results not shown; $R^2 = .089$).

Turning to statistical Models 2a and 2b in Table 3, we observe that the effect of high job strain (the summary measure) no longer remains significant, indicating that the models’ single scales capture most of the significant effect on mental health functioning and that no synergy effect may result from combining the scales (Model 2a). Similarly, in the case of the effort–reward imbalance model (Model 2b), high effort, low reward, and high overcommitment remained significant in Model 2b, but the summary measure effort–reward imbalance lost its statistical significance. Again, no synergy effect is expected to result from a combination of scales. If compared with Model 1, the Models 2a and 2b provide better model fits, and they explain a higher proportion of variance (especially so in the case of the effort–reward imbalance model [13.0%] compared with the demand-control-support model [10.9%]).

Finally, when combining all scales of the two work stress models in a simultaneous analysis (Model 3), the coefficients of the main scales within each model remain statistically significant. This latter finding indicates that the significant scales exert an independent effect on mental health functioning and that they remain important when studying simultaneously the effects of each single scale of both work stress models. However, since there was a modest increase in the variance explained from Models 2a and 2b to Model 3 (from 13.0% to 13.7%), this result should not be overemphasized.

A parallel set of results is displayed in Table 4 with regard to physical health functioning (PCS). Turning to Model 1, we again observe significant effects of all scales of the two models, except in the case of low decision latitude and its subscales. However, the explanatory power (R^2) was generally lower than was the case for mental health (Table 3). In addition, the relative increase in model fit was comparatively low compared with a model with control variables and confounders only (results not shown; $R^2 = .076$). Considering the demand-control-support model, strong effects were found for high psychological demands, physical demands and high job strain, but less so for social support (as was the case for mental health functioning). The conclusion that social support at work may be less important for physical compared with mental health functioning is further supported by findings of Model 2a, where significant associations were found for “psychological” and “physical demands” only.

With respect to the effort–reward imbalance model (Model 2b), the summary measure exerts a synergetic effect, once the effects of the single scales, “effort” and “reward,” are controlled. This latter result provides some justification of introducing a summary measures in addition to the models’ single scales. When looking at the results of Model 3 (Table 4), the summary measure effort–reward imbalance maintains its statistically significant effect on poor physical health functioning, whereas in the case of the demand-control-support model, significant effects are restricted to the demanding aspects of stressful work.

Again, a small increase in model fit was observed in the final model 3 and scales remained significant, thus supporting further the notions that the significant scales act independently on physical health functioning and that by combining both work stress models the explanation of the physical composite score in our sample is strengthened.

In line with our theoretical argument (see Introduction), we additionally expect two specific interaction terms of single components of the two work stress models to exert significant effects on health functioning later on. First, health risks are increased if high job strain is combined with low social support at work, and second, health risks are increased if effort–reward imbalance is combined with high overcommitment. Respective analyses are presented in Table 5, where interactions between the relevant scales were tested together with the single scales of interest. With regard to the mental composite score, we found no support for a significant interaction term in either case (High job strain × Low social support; Effort–reward imbalance × High overcommitment). Yet, in the case of the physical health functioning score, a significant interaction term was observed for the latter model, with an effect of the combination effort–reward imbalance and high overcommitment above and beyond the effects produced by the single components.

Discussion

This paper used data from the Gazel cohort to study long-term effects of mid-life psychosocial work stress on health functioning after labor market exit. To assess psychosocial work stress, we used the full original versions of the JCQ measuring the demand-control-support model and of the effort–reward imbalance questionnaire, measured in 1998. Health functioning is assessed 9 years later (in 2007) using the SF-36 mental and physical composite scores. The specific objectives of the paper are to study and compare the relative contribution of two important work stress models (including combined scales, single scales and subscales of the models) on health functioning after labor market exit within the frame of a large prospective study design.

Taken together, main results were as follows: First, findings showed significant effects of both work stress models and their single components on prospective mental and physical health functioning, even if baseline health was taken into account. Though, some differences in effect sizes of the single scales were found according to the health outcomes under study. In the case of the demand-control-support model, the strongest effects were observed for the scale psychological demands for both outcomes, although the scale social support at work was found to be particularly important for the mental composite score and the scale physical demands was important for the physical composite score. Notably, when analyzing the simultaneous effect of the single scales of the demand-control support model, no synergetic effect of high job strain was observed once the two components high psychological demands and low decision latitude were considered—neither for the mental nor for the physical composite score.

In the case of the effort–reward imbalance model, the three single scales effort, overcommitment, and effort–reward imbalance showed strongest effects for the mental composite score, whereas no additional synergetic effect of effort–reward imbalance was found once the single scales were controlled for. Yet in the case of physical health functioning, the mismatch between effort and reward was found to be particularly important and remained significant in Model 2. Thus, although results of Model 1 lend support to the theoretical assumption of the two work stress models that strongest effects on health are observed if the summary measures are analyzed (high job strain, effort–reward imbalance), this support is weakened if models also include the single scales of the summary measures. Still, in the case of effort–reward imbalance, a summary effect remains statistically significant with regard to poor physical health functioning.

A second finding concerning the comparison of the two work stress models is of interest. When comparing the explanatory power of the models, we found that the explained variance was slightly higher for the effort–reward imbalance model (for the mental composite score only). Moreover (for the mental and for the physical composite score), the highest predictive power was found in the final statistical models (Model 3), when the combined effect of the scales was simultaneously analyzed. This suggests that each work stress model makes a distinct contribution toward explaining health functioning after labor market exit.

Third, we found preliminary support for an interaction term of high effort–reward imbalance with overcommitment (in the case of physical health functioning), strengthening the model's theoretical assumption that the intrinsic source of high effort (overcommitment) exerts particularly adverse effects on health if manifested in an extrinsic context of high effort and low reward.

Given the prospective design of our study and the analysis of long-term effects of working conditions on health, our findings add to the existing literature of health determinants at older ages by pointing to the relative importance of midlife psychosocial working conditions not only for health in mid-life but also for health functioning after labor market exit. Hence, the results extend former findings, suggesting that both work stress models contribute independently to the explanation of health variations (Bosma, Peter, Siegrist, & Marmot, 1998, Kivimaki et al., 2002; Stansfeld et al., 1998). This is particularly obvious in the case of mental health functioning, where all single scales remained significant in the final model and where the explained variance was relatively highest. Furthermore—albeit the overall explained variance was relatively small—an important part (4.8% of 13.7%) was shown to be related to the work stress scales rather than to the control variables of our analyses (including social position and baseline self-perceived health). Apparently, midlife must be considered a crucial period of life with long-term effects on health functioning in later life (Breeze et al., 2001). During midlife, core social roles (in particular work) are acquired, which provide opportunities of important experiences of success and failure. Through these roles, essential material and nonmaterial needs are satisfied. Quality of work and employment (in terms of the psychosocial work environment) may play a crucial role in this process, maintaining or even strengthening health functioning and well-being of employed people under favorable conditions, and deteriorating their health and well-being under adverse conditions. These results support efforts to improve the quality of work and the health of working people, as evidenced by the results of respective theory-based interventions (Bourbonnais, Brisson, & Vézina, 2010).

Limitations

The study design including its large study sample and very low attrition rates between the different measurement waves must be considered a particular strength of the study. Moreover, given the application of the full version of validated theory-based measures of work stress and given a systematic analysis of the available scales, the theoretical basis of this study adds to its strength. However, some limitations must be mentioned. First, we were not able to rule out a reporting bias of work stress caused by some unobserved personality characteristics, such as neuroticism, negative affectivity or depression. Yet, previous studies testing adverse health effects of work stress demonstrated that these effects remain statistically significant after adjusting for negative affectivity

(Bosma et al., 1998), a main possible confounder in this respect (Spector, Chen, & O'Conell, 2000). Second, baseline values of SF-36 in 1998 were not collected, and we therefore introduced self-reported health as a proxy measure for respective adjustment in multivariate analysis. It should be noted that correlations between self-perceived health and health functioning in 2007 were found to be relatively strong (PCS: 0.43, MCS: 0.37), suggesting that self-perceived health is an appropriate proxy for health functioning at baseline. It may be, however, that some unmeasured baseline functional states influence both baseline work stress and subsequent outcomes in 2007. Third, by restricting the sample to people that already left the labor market in 2007, some selection bias could affect our findings, given that poor health might be one reason for labor market exit. Yet, same results were found when associations between work stress and subsequent health functioning were analyzed for respondent still employed in 2007. Moreover, the sample was restricted to people that were employed between 1997 and 1999 with available information for all variables. While this serves our aim to compare the different work stress models and its scales, the results might be affected by response bias. However, when comparing the final sample to the group of excluded respondents no differences with regard to our core measures were observed. Fourth, by assessing work stress within a restricted time frame, we may underestimate its long-term effect as previous research documented a dose–response effect between the number of consecutive measurements of work stress over time and the strength of their effects on health (Chandola, Brunner, & Marmot, 2006). A wider time frame would also be informative because we observed an age gradient in our sample. An additional limitation points to the fact that despite a fairly generalizable population (M. Goldberg et al., 2007), conclusion from the Gazel cohort must be drawn carefully because important segments of the population (e.g., nonworking women, self-employed workers) are underrepresented. Moreover, compared with the general population, working and retirement conditions of the Gazel cohort are assumed to be generally better, given low levels of temporary contracts and downward mobility during working life and a relative good financial situation after labor market exit with a secure pension scheme. Yet this might rather underestimate the impact of work stress in our study.

Conclusion

In conclusion, despite the reported limitations, this study supports the notion that poor psychosocial working conditions, measured according to the demand-control-support model, and the effort–reward imbalance model are prospectively linked to reduced health functioning, in particular mental health functioning. These findings may have important implications for interventions and recommendations to improve working conditions that contribute to healthy aging.

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