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Assessment of job stress factors in a context of organizational change

Évaluation des facteurs de stress au travail dans un contexte de changement organisationnel

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abstract

Introduction. – Research consistently showed that stress and organizational change are closely related.

Objective. – This study was conducted to identify the psychosocial job characteristics that are responsible for psychological stress in a context of organizational change.

Method. – An expanded 30-item version of the Job Content Questionnaire was used to measure psychological demands, decision latitude, supervisor support, coworker support, and organizational difficulties. Online survey responses from 973 employees from the university of Strasbourg were analyzed.

Results. – Confirmatory Factor Analyses indicated a poor fit of the five-factor model based on 30 items but an acceptable to good fit of a reduced five-factor model based on 26 items. Results from a stepwise regression showed that the organizational difficulties dimension was the second most important predictor of psychological stress.

Conclusion. – The implications of these findings for further work on health outcomes of organizational changes closed this study.

résumé

Introduction. – Les recherches ont montré de manière consistante que stress et changements organisationnels sont étroitement liés.

Objectif. – Cette étude a été conduite dans le but d'identifier les facteurs psychosociaux vecteurs de stress au travail, dans un contexte de changement organisationnel.

Méthode. – Une version élargie du Questionnaire de Satisfaction au Travail de Karasek a été utilisée pour mesurer la demande psychologique, la latitude de décision, le soutien de la hiérarchie, le soutien des collègues et les difficultés organisationnelles. Les réponses à un questionnaire en ligne obtenues auprès de 973 employés de l'université de Strasbourg ont été analysées.

Résultats. – Les Analyses Factorielles Confirmatoires ont montré une mauvaise adéquation entre le modèle théorique en 5 facteurs et l'échelle initiale de 30 items mais une bonne adéquation si l'échelle est réduite à 26 items. Les analyses de régression pas à pas ont montré que les difficultés organisationnelles représentent le deuxième prédicteur le plus important du stress perçu.

Conclusion. – Les implications de nos résultats en termes de santé au travail sont discutées en fin d'article.

Mots clés :

Facteurs de stress au travail

Changements organisationnels

Questionnaire de Satisfaction au Travail

1. Introduction

Organizational change is an integral part of today's working life and can be viewed as a critical life event, which has potential negative outcomes on employees. Indeed, employees are likely to experience uncertainty over the nature of their job and new work environment and insecurity over their personal career. Numerous studies have found that structural changes within organizations

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create a range of work-related stressors such as role ambiguity, increased job demands (long hours, increased workload and pressure. . .), lowered control, as well as changes in opportunities for social support from supervisors (less manager availability, lack of guidance, lack of recognition. . .). These factors may, in turn, lead to increased levels of psychological stress, less job satisfaction, declining levels of organizational commitment and detrimental effects on individual health (Hansson, Vingard, Arnetz, & Anderzen, 2008; Jimmieson, Terry, & Callan, 2004; Kivimäki, Vahtera, Elovainio, Pentti, & Virtanen, 2003; Noblet, Rodwell, & McWilliams, 2006; Tvedt, Saksvik, & Nytro, 2009). The present research follows this line of work. Its focus is on identifying the psychosocial job characteristics that are responsible for psychological stress in a context of organizational change.

The framework for this research is based on the most widely used theoretical model in the field of research on the relationship between work and stress, the Demand-Control-Support (DCS) model, also known as the job strain model, formulated by Karasek (1985). Originally, the job strain model (Karasek, 1979) focuses on two important dimensions in work situation: psychological job demand and job control or decision latitude. Psychological demand refers to the workload in terms of quantity of work and time constraints. Job control or decision latitude refers to the worker's possibility to control his or her own work activities (De Araujo & Karasek, 2008; Brisson et al., 1998; Karasek, 1979). This dimension includes two highly related sub-dimensions: skill discretion, i.e. the possibility to use and develop one's skills, and decision authority, i.e. the possibility to make decisions about one's own work (Niedhammer, 2002; Niedhammer, Chastang, Gendrey, David, & Degioanni, 2006; Theorell & Karasek, 1996). The model hypothesizes that a combination of high psychological demands and low decision latitude produces high job strain, which predicts adverse health problems, such as cardiovascular diseases, muscular skeletal diseases, and poor psychological well-being (Johnson & Hall, 1988; Karasek, 1979; Karasek & Theorell, 1990; Kawakami & Haratani, 1999; Kristensen, 1995). In the 1980s, the Job Demand-Control model has been extended to include a social support dimension (Johnson & Hall, 1988; Johnson, Hall, & Theorell, 1989), resulting in the Job Demand-Control-Support (DCS) model. Social support can be defined as the availability of people on whom one can turn in times of need (Sarason, Levine, Baham, & Sarason, 1983). Previous studies consensually distinguished social support received from supervisors and/or from colleagues and considered that these two dimensions often "buffer" the impact of high psychological demands and low decision latitude (Johnson & Hall, 1988; Van der Doef & Maes, 1999). Although this model has provided key insights into the relationship between work and stress, it has been criticized for its parsimonious focus on a general set of job characteristics contributing to employees' well-being at work at the expense of more situation-specific factors (Noblet et al., 2006; Peeters and Le Blanc, 2001; Sparks & Cooper, 1999). Consequently, it may be not sufficiently appropriate for understanding stress in a specific context such as a context of organizational change. Karasek himself already questioned the integration of an organization-level job factor into his model, acknowledging that the effects of organizational difficulties on determining work environment appear to be fundamental (Karasek et al., 1998). Thus, in line with our focus, the Job DCS model used in this study has been expanded to include an organizational change dimension.

The classical instrument used in connection with the DCS model is the Job Content Questionnaire (JCQ) elaborated by Karasek (1985). This self-administered questionnaire can be considered as a standardized instrument to assess job stress. Numerous studies have explored the psychometric properties of the JCQ and highlighted its reliability and validity in various languages and cultural contexts and among different working populations (Cheng,

Luh, & Guo, 2003; De Araujo & Karasek, 2008; Eum et al., 2007; Karasek et al., 1998; Kawakami & Fujigaki, 1996). The French version of the JCQ was examined and validated in the region of Quebec (Brisson et al., 1998) and in two major national surveys in France: the SUMER survey (Niedhammer, 2002) and the GAZEL cohort (Niedhammer et al., 2008). The results of these different validation studies consistently supported the theoretical structure of the Demand-Control-Support model. Factor analyses showed that the expected dimensions of psychological demand, decision latitude and social support were clearly found. Moreover, results generally supported the division of decision latitude into skill discretion and decision authority, and the division of social support into coworker support and supervisor support (e.g. De Araujo & Karasek, 2008; Kawakami & Fujigaki, 1996; Niedhammer, 2002). Nevertheless, these studies also underlined the existence of some problematic items. In particular, the items "conflicting demands" and "wait and others" consistently had low loadings on the psychological demand factor (Brisson et al., 1998; De Araujo & Karasek, 2008; Eum et al., 2007; Karasek et al., 1998; Kawakami, Kobayashi, Araki, Haratani, & Furui, 1995; Laroque, Brisson, & Blanchette, 1998; Niedhammer, 2002). These results raise the question of whether these items really refer to the work load in terms of quantity of work and time constraints such as "work hard", "work fast", "excessive work" or "not enough time". Rather, we can hypothesize that these items may be associated with organizational difficulties, a factor that is not included in the JCQ, but that could be particularly relevant in the specific context of organizational change (Karasek et al., 1998).

To sum up, the focus of this study is on identifying the psychosocial job characteristics that are responsible for psychological stress in a context of organizational change. We thus aimed (1) to measure Demand-Control-Support dimensions through a version of the French JCQ (Niedhammer et al., 2006) that has been expanded by incorporating specific items related to difficulties from organizational change; and (2) to examine the fit of this new version of the JCQ with data, its psychometric properties (as measured by internal consistency, cross-scale correlations, discriminant validity), and its relationship with psychological stress. Our main purpose was to examine how the new organizational change dimension can play a role in accounting for psychological stress variance by improving prediction of psychological stress beyond that afforded by the more classical factors of the JCQ. Specifically, we expected that the more an employee viewed difficulties from organizational change, the more he/she perceived psychological stress (controlling for the impact of the other stress factors on psychological stress).

2. Method

2.1. Organizational background

The present study was conducted in the context of an important organizational change within a large French university: the university of Strasbourg. The origins of the university of Strasbourg date back to the early 16th century, with the aim to develop medicine, theology, philosophy, and law areas. Following several historic developments, three separate universities were created in 1968 focusing on sciences, humanities, and law. During the last two decades, the three universities have been working together to manage ambitious projects. Encouraged by this experience, they decided to link their forces in only one university, in order to face the challenging international competition. This important fusion led to a large organizational restructuring, including the reassignment of staff into new work units, the introduction of intermediate management positions, and substantial modifications to

Table 1

Results from the CFA conducted on the expanded (30-item) French version of the JCQ (first subsample).

Items of the expanded version of the French JCQ	Factors				
	Psychological demands	Decision latitude	Supervisor support	Coworker support	Organizational difficulties
No excessive work ^a	.75				
Hectic job	.75				
Enough time ^a	.71				
Work fast	.71				
Work hard	.70				
Tasks interrupted	.64				
Intense concentration	.47				
Wait on others	.37				
Conflicting demands	.36				
Allows own decisions		.74			
Requires creativity		.65			
A lot of say		.64			
Little decision freedom ^a		.60			
Develop own abilities		.60			
Variety		.56			
High skill level		.51			
Repetitive work ^a		.45			
Learn new things		.25			
Supervisor pays attention			.92		
Supervisor concerned			.88		
Helpful supervisor			.87		
Supervisor good organizer			.82		
Coworkers interested in me				.83	
Friendly coworkers				.79	
Coworkers helpful				.72	
Coworkers competent				.63	
Unclear responsibilities					.63
Information not provided					.62
Useless processes					.57
A lot of intermediates					.56

Items are ordered according to the size of their loadings.

^a The response categories for these items were reversed before the CFA.

established operating methods. It can therefore be speculated that such a large scale change is likely to introduce a major source of stress (Callan, 1993; Jimmieson et al., 2004).

2.2. Participants and procedure

The university of Strasbourg employs 4650 permanent staff: 2680 teaching/research staff, 1970 administrative/technical staff. All employees were invited to take part anonymously in the present study. Data collection consisted of filling out an online self-administered questionnaire. A total of 973 employees from the three original institutions (40% males and 60% females) completed and returned the survey. There were no differences in participation rates among the three institutions. The age boundaries span the full adult working life: from 22 to 68 (mean age = 42). All the types of university activities were equally represented: about one third held a teaching position and the remaining two thirds held a technician and/or an administrative position(s). This sample was randomly divided into two subsamples of equal size. The first one (n = 487) was used to examine the fit of the expected model based on our expanded version of the JCQ, and, if necessary, to propose a new model. The second one (n = 486) was used to test the fit of the model derived from the first analysis, its psychometric properties, and to determine the effects of its components on psychological stress.

2.3. Measures

The questionnaire used in this study was divided into two sections. The first section comprised an expanded version of the Job Content Questionnaire (30 items), including the 26-item version

of the French JCQ (psychological demands – nine items, decision latitude – nine items, and social support – eight items, Niedhammer et al., 2006), and a set of four new items based on the results of a qualitative pilot study involving a cross-section of 257 staff members (92 teaching/research staff, 165 administrative/technical staff), chosen randomly from all the components of the university. In this pilot study, 37 semi-structured focus groups were conducted to explore the sources of stress experienced by the participants in their workplace in a context of organizational change. The new items were “Information needed to do a good job is not provided in time”, “Being successful in my job mostly requires a lot of intermediate coworkers”, “The responsibilities for each one are not well defined” and “I have to follow procedures of which I do not always understand the relevance”. These items may inherently refer to organizational difficulties, particularly relevant in a context of organizational change. More specifically, these items seem to refer to (1) a lack of clarity in roles, tasks or responsibilities that an employee is expected to fulfill, and (2) difficulties regarding communication among partners who could give different meanings to the same situation (Kohler, Munz, & Grawitch, 2006). For all items, answer choices were presented on a four-level-scale ranging from “strongly disagree” to “strongly agree”.

The second part of the questionnaire included the “Psychological Stress Measure” scale (PSM, Lemyre & Tessier, 2003). This scale was composed of nine items related to the subjective experience of feeling stressed (e.g. “I feel preoccupied, tormented, or worried”). Respondents scored each item using an 8-point scale varying from “not at all” to “extremely”.

This scale was used as a single measure of psychological stress, which could be used as criterion to test the predictive power of the dimensions of the JCQ.

2.4. Statistical analysis

All the analyses were performed using the SPSS version 15.0 (SPSS Inc, 2006). A total of 111 participants with more than 10% missing data (viz. more than three missing items for JCQ) were excluded from the analyses. Participants with less than 10% missing data were kept by substituting the mean value for missing items (overall, 129 missing data were replaced).

For the Confirmatory Factor Analyses (CFA), latent factors were defined by their respective items, correlations between latent factors were permitted, and Modification Indices were used to guide model refinements. The Maximum Likelihood method with the χ^2 statistic (χ^2) was used to test the fit of the models. Because the χ^2 is known to be affected by sample size (Kline, 1998), other fit indices notably recommended by Hu and Bentler (1999) were also used: the normed χ^2 (χ^2/df), the goodness of fit index (GFI), the comparative fit index (CFI), the root mean square error of approximation (RMSEA) and the Standardized Root Mean Square Residual (SRMR). A good fit is obtained when normed χ^2 is 3 or lower, GFI and CFI are .90 or higher, RMSEA and SRMR are .05 or lower (Roussel, Durrieu, Campoy, & El Akremi, 2002). Internal consistency for each scale was evaluated by two coefficients: Cronbach's alpha coefficient (α) was used to allow comparisons with literature (given that previous studies mainly used it to assess internal consistency); rho coefficient (ρ) was used because it is more adapted to Structural Equations Modeling (see Hair, Black, Babin, & Anderson, 2010, for details). For the same reasons, cross-scale correlations were calculated using phi coefficient (ϕ) and Pearson's coefficient (r). Discriminant validity was assessed through the comparison of the Average Variance-Extracted (AVE) values for any two factors with the square of the correlation estimate between these two factors (see Hair et al., 2010, for details). Finally, we conducted a stepwise regression analysis to determine the effects of the dimensions of our model on psychological stress.

3. Results

3.1. Structure of the expanded French version of the JCQ (30 items)

A first CFA has been carried out over the first subsample. Based on previous validations of the French version of the JCQ (Niedhammer, 2002; Niedhammer et al., 2006) and the inclusion of four items we assumed to represent one single dimension of organizational difficulties (related to role ambiguity and communication problems – see Kohler et al., 2006, for details), we expected and tested a five-factor model using Psychological demands, Decision latitude, Supervisor social support, Coworker social support and Organizational difficulties as factors.¹ This model is shown in Table 1. The normed χ^2 of the model was 3.124. The values of GFI and CFI were respectively .847 and .867. The RMSEA was .066 and the SRMR was .091. Clearly, this model did not fit the data well. Furthermore, low standardized loadings ($<.50$ or even $<.40$) were found on their intended factor for the following items: “learn new thing” (.25), “conflicting demands” (.36), “wait on others” (.37), “repetitive work” (.45), and “intense concentration” (.47). As noted

¹ In this model, all correlations between residuals were constrained to be zero, except for four pairs of residuals. These correlations were both guided by modification indices and by the very similar contents of the correlated items. Authorized correlations were between “no excessive work” and “enough time” (both refer to time constraints/pressure), “work fast” and “work hard” (quantity of work), “task interrupted” and “hectic job” (organization constraints on task completion), and “useless processes” and “information not provided” (organizational difficulties related to communication).

previously, the items “conflicting demands” and “wait on others” have repeatedly been identified as problematic because of their low loadings on the psychological demand factor (e.g., Brisson et al., 1998), much in the same way than “learn new things” and “repetitive work”, two items previously identified as poorly loading on the decision latitude factor (see for example Karasek et al., 1998; Niedhammer, 2002). The latter two may not fully reflect skill discretion defined as the possibility to use and develop one's skills (see Kawakami et al., 1995, for details). Moderate contribution to its factor was also found for the item “intense concentration” and it is no longer with recommended items for psychological demands scale (see JCQ Center for details). Finally, another item – “high skill level” – also appeared problematic in our study probably because of semantic ambiguity. Formulating “my job demands high skill level” may introduce confusion around the verb “demand” with items like “my job demands to work fast” or “my job demands to work hard” which typically loaded on the psychological demands factor. As a consequence, this item could be considered as referring to psychological demands rather than to decision latitude. The very small difference found between its two standardized loadings on the Decision latitude factor ($=.51$) and on the psychological demands factor ($=.37$, not shown) when cross-loadings were permitted confirmed this interpretation. Brisson et al. (1998) suggested the same idea to explain the high loadings of “high skill level” on both factors.

Present findings nicely corroborate previous works and, following Niedhammer (2002), present results can lead to the conclusion that the relevance of some items could be questioned for the factorial structure of the instrument and thus provide a potential basis for future revision. Therefore, we decided to make some adjustments in an attempt to improve the model. Four of the six problematic items were excluded. We decided to keep “conflicting demands” and “wait on others” in the analysis considering that these items might contribute to a new factor, related to organizational difficulties, potentially relevant in a context of organizational change.

3.2. Structure of the new version of the JCQ

A new version of the French JCQ was designed. This version was composed of 26 items: 22 items from the initial French version of the JCQ, and the four new items introduced on the basis of our pilot study, formulated in a positive way. If a more balanced pattern of items could be an extra benefit for any scale, in the classic French version of the JCQ only four out of 26 items are reversed. Accordingly, the valence of these additional items was not balanced.

A CFA was run on the second subsample, with exactly the same specifications as the first CFA. Again, our five-factor model was tested, still using Psychological demands, Decision latitude, Supervisor social support, Coworker social support and Organizational difficulties as factors, but setting different items as components. The psychological demands and decision latitude factors were reduced to six items and the organizational difficulties factor consisted of six items, namely “wait on others” and “conflicting demands” in addition to “a lot of intermediates”, “information not provided”, “useless processes”, “unclear responsibilities”. Note that the two additional items strengthen the idea of role ambiguity and communication problems previously mentioned. This model appears in Table 2. It indicated a normed χ^2 statistic of 2.517; GFI and CFI values were .898 and .921; the RMSEA was .056 and the SRMR was .073. Furthermore, all loadings were higher than .50. As shown by these indices, the fit of this five-factor model is an acceptable to good fit. More importantly, this fit is superior to that of the five-factor model first tested (for example, the value of χ^2/df of this

Table 2

Results from the CFA conducted on the new (26-item) French version of the JCQ (second subsample), internal consistency (rho and alpha coefficients), and Average Variance-Extracted (AVE) estimates.

Items of the new French JCQ	Factors				
	Psychological demands	Decision latitude	Supervisor support	Coworker support	Organizational difficulties
No excessive work ^a	.79				
Hectic job	.75				
Enough time ^a	.72				
Work fast	.64				
Work hard	.59				
Tasks interrupted	.58				
Allows own decisions		.72			
A lot of say		.70			
Develop own abilities		.66			
Little decision freedom ^a		.61			
Requires creativity		.57			
Variety		.54			
Supervisor pays attention			.93		
Helpful supervisor			.90		
Supervisor concerned			.89		
Supervisor good organizer			.75		
Coworkers interested in me				.78	
Friendly coworkers				.78	
Coworkers helpful				.75	
Coworkers competent				.64	
A lot of intermediates					.62
Conflicting demands					.60
Information not provided					.58
Useless processes					.55
Wait on others					.51
Unclear responsibilities					.50
Internal consistency ρ (α)	.84 (.85)	.80 (.80)	.92 (.92)	.83 (.82)	.73 (.74)
AVE estimates ^b	.47	.40	.75	.55	.31

Items are ordered according to the size of their loadings. Alpha coefficients are given in parentheses.

^a The response categories for these items were reversed before the CFA.

^b AVE = $\sum \lambda^2/n$ (λ represents the standardized factor loading and n is the number of items) (Hair et al., 2010).

model was lower than the value of χ^2/df of the five-factor model first tested: $2.517 < 3.124$).²

3.3. Psychometric properties of the JCQ five-factor model

3.3.1. Internal consistency

Alpha and Rho coefficients are presented in Table 2. All values were higher than .70, indicating that the internal consistency was good for each factor.

3.3.2. Cross-scale correlations

Table 3 shows that the highest relations were found between Organizational difficulties and the other factors (except Coworker social support). Psychological demands were not significantly related to Decision latitude and Coworker social support, and had a low negative relation with Supervisor social support. Supervisor social support and Coworker social support were positively and moderately correlated. These two scales of social support were also positively and moderately correlated with Decision latitude.

3.3.3. Discriminant validity

Table 2 shows the Average Variance-Extracted (AVE) values for the five scales. As we can see, no value was as low as .29, which was the highest square of the correlation estimate between two factors (Psychological demands and Organizational difficulties). The fact that each factor explained more of the variance in its item measures than it shared with another factor provided good evidence of discriminant validity.

² Note that this difference between the values of χ^2/df cannot be interpreted as a test statistic because we compared two nonhierarchical models.

3.4. Predictive power of the JCQ five-factor model on psychological stress

We expected that the organizational change dimension made a unique contribution to the psychological stress variance, i.e. the more an employee viewed difficulties from organizational change, the more he/she perceived psychological stress (controlling for the impact of the other stress factors on psychological stress).³ To test this hypothesis, a stepwise regression analysis (forward selection) was conducted in order to identify the dimension (or the set of dimensions) of the JCQ five-factor model, which contributed the most in predicting psychological stress. Table 4 displayed the unstandardized regression coefficients (B), the standardized regression coefficients (β), the semi-partial correlations (sr^2) and the squared multiple correlation (R^2) after entry of all five dimensions (as IVs). The best predictor of psychological stress was the psychological demands factor, with $sr^2 = .310$, $F_{inc}(1,484) = 216.95$, $p < .001$. The organizational difficulties factor appeared at step 2: it contributed significantly to the prediction of psychological stress ($sr^2 = .087$, $F_{inc}(2,483) = 69.53$, $p < .001$), and led to an improved prediction of psychological stress beyond that afforded by Psychological demands. The supervisor social support factor appeared at step 3; it contributed significantly to the prediction of psychological stress ($sr^2 = .028$, $F_{inc}(3,482) = 23.13$, $p < .001$), and led to an improved prediction of psychological stress beyond that afforded by Psychological demands and Organizational difficulties. The

³ Before performing regression analysis, we first checked the internal consistency of the psychological stress scale. The alpha coefficient ($\alpha = .89$) indicated a very good reliability for this scale, allowing us to compute a mean score for it by averaging the scores of its nine corresponding items. A mean score was also computed for each of the five factors of our model.

Table 3
Correlations between factors: phi coefficients (ϕ) and Pearson's coefficients (r) (second subsample).

Factors	Psychological demands		Decision latitude		Supervisor support		Coworker support	
	ϕ	r	ϕ	r	ϕ	r	ϕ	r
Decision latitude	.00	.05						
Supervisor support	-.12*	-.11*	.36***	.30***				
Coworker support	-.03	-.01	.27***	.22***	.30***	.29***		
Organizational difficulties	.54***	.39***	-.46***	-.34***	-.41***	-.36***	-.21***	-.19***

* $p < .05$; *** $p < .001$.

Table 4
Stepwise regression (forward selection) of dimensions of the five-factor model on Psychological stress (DV).

Factors (IVs)	Regression coefficient			
	B	β	Δsr^2 (incremental)	R^2
Psychological demands	1.10	.44	.310***	
Organizational difficulties	0.67	.24	.087***	
Supervisor support	-0.33	-.18	.028***	
Decision latitude	-0.10	-.03	.001	
Coworker support	0.05	.02	.000	.425

In order to make sure of inclusion of all dimensions, the usual statistical criteria for entry (F) was dropped.

*** $p < .001$.

decision latitude and coworker social support factors didn't further contribute significantly to the prediction of psychological stress in this study. Altogether, the five dimensions of the expanded version of the French JCQ explained 42.5% of the variability in psychological stress. These findings support our hypothesis: the inclusion of the organizational difficulties factor results in a significant increment in predicting psychological stress.⁴

4. Discussion

The aim of the present study was to identify the psychosocial job characteristics that predict psychological stress in a context of organizational change.

As a first step, we measured Demand-Control-Support dimensions through an expanded 30-item French version of the JCQ. A CFA was carried out on this expanded 30-item scale using Psychological demands, Decision latitude, Supervisor social support, Coworker social support and Organizational difficulties (related to role ambiguity and communication problems) as factors. Our findings show that this model does not provide an acceptable fit and highlights some problematic items with low or only moderate standardized loadings on their intended factor (i.e. "wait on others", "conflicting demands", "repetitive work", "learn new thing", and "intense concentration") or with cross-loadings (i.e. "high skill level"). These results are in agreement with previous studies that also reported the same troublesome items and questioned the fit of the JCQ model⁵ with data (Brisson et al., 1998; De Araujo & Karasek, 2008; Eum et al., 2007; Kawakami et al., 1995; Niedhammer, 2002). As already suggested in many of these studies, the fit of the JCQ model might be improved by removing these items. For two of them

⁴ Another interesting procedure to test our hypothesis is to perform a two-step hierarchical regression introducing at step 1 the four classic factors of the JCQ and at step 2 the classic factor and the new organizational difficulties factor. This procedure allows us to test whether the new dimension accounts for additional variance in explaining psychological stress beyond the classic factors taken together. Results showed that after step 1, $R^2 = .386$ ($F(4,481) = 75.58$, $p < .001$). After step 2, $R^2 = .425$ ($F(5,480) = 70.98$, $p < .001$). Addition of organizational difficulties to the equation results in a significant increment in R^2 (R^2 change = .039, $F(1, 480) = 32.68$, $p < .001$).

⁵ Because the scale of organizational difficulties was not a part of the JCQ in previous studies, the aforementioned "JCQ model" actually refers to the classical four-factor model or some variations of it (with a subdivision of Decision latitude for example).

("conflicting demands" and "wait on others"), we hypothesized that they may rather be associated with organizational difficulties, and this could be of particular interest in the context of organizational change, a process specifically explored in the present study.

Therefore, we decided to remove four of these problematic items and to shift the remaining ones ("conflicting demands" and "wait on others") to the dimension of organizational difficulties, resulting in a new 26-item French version of the JCQ. The CFA conducted on this version tested a new five-factor model still with the dimensions of psychological demands, decision latitude, supervisor social support, coworker social support, and organizational difficulties, including respectively six, six, four, four and six items as components. The fit of this five-factor model proved to be acceptable to good. More importantly, this fit was better than the fit of the first tested model and better than those of previously tested models as well (see Niedhammer, 2002, who qualified as "low" the fit of her best model).

The psychometric properties of this five-factor model of the French JCQ have proven to be satisfactory or even good. Rho and alpha coefficients indicated a high internal consistency of the five scales. For Decision latitude and the two dimensions of social support, these coefficients were comparable to previous studies. For Psychological demands, internal consistency appeared to be stronger than in other studies (e.g. Brisson et al., 1998; Karasek et al., 1998; Kawakami & Fujigaki, 1996; Niedhammer, 2002).⁶ This finding definitely shows that our five-factor model of the French JCQ is an appropriate instrument to measure Demand-Control-Support dimensions and organizational difficulties, especially as Psychological demands and Decision latitude are composed of a lower number of items compared to previous studies. In this five-factor model, correlation between the supervisor and coworker social support scales as well as correlation between these two scales and Decision latitude were moderate to high and consistent with earlier studies (Karasek et al., 1998; Niedhammer, 2002; Niedhammer et al., 2006). In line with previous findings, low or non-significant correlations were observed between the psychological demands scale and the two scales of social support (e.g., Karasek et al., 1998;

⁶ For organizational difficulties, it was not possible to make comparison with literature because this scale is an original one. In reference to classical cut-off values, this scale has a good internal consistency ($\rho = .73$; $\alpha = .74$).

Kawakami et al., 1995). One of the most interesting results in the present study was the lack of correlation between the scale of psychological demands and the scale of decision latitude ($\rho = .00$, n.s. and $r = .05$, n.s.), a result only reported by two authors previously (Eum et al., 2007; Niedhammer et al., 2006), and which supports the theoretical independence of these two dimensions. In other words, the psychological demands scale and the decision latitude scale of our version of the French JCQ explore two purely distinct psychosocial constructs (see Karasek et al., 1998, for a discussion about the importance of this distinction). The organizational difficulties scale exhibited a strong and positive correlation with the psychological demands scale, a strong and negative correlation with the scales of decision latitude and supervisor social support, and a moderate and negative correlation with the coworker social support scale. This result illustrates the well-documented consequences of organization change which include increased job demands, loss of control, and reduced opportunities for social support, through the introduction of new technology, set of procedures, and management systems (Kivimäki et al., 2003). We further explored the structure of our version of the French JCQ by analyzing discriminant validity. For each dimension, the Average Variance-Extracted (AVE) value was higher than the value of shared variance with another dimension. This result shows that the measurement of each dimension is highly specific. Focusing on the scale of organizational difficulties, it means that this scale is neither collinear with the other scales nor totally independent. In sum, this result reveals adequate discriminant validity between factors.

Finally, the impact of the five-factor model on psychological stress was tested through stepwise regression analysis. Results showed that the best predictor of psychological stress was the psychological demands factor. Interestingly and in line with our hypothesis stating that the organizational change plays an important role in accounting for psychological stress, the organizational difficulties factor appeared as the second best predictor and led to an improved prediction of psychological stress beyond that afforded by psychological demands. The last significant contribution to the prediction of psychological stress was given by the supervisor social support factor. We observe that the decision latitude factor did not significantly influence psychological stress. This result seems to be consistent with previous research testing different job control subscales for explaining stress and showing that the control over resources needed to perform the tasks scale (which is close to our decision latitude factor) is not a direct predictor of stress (Hansez, 2008). As a whole, the five-factor model accounted for almost a half of the variability in psychological stress. It is however difficult to compare our study with data from the literature because of several methodological and empirical differences about how the Demand-Control-(Support) model was tested. First, this study is the first to introduce an organizational difficulties factor in its model. Second, previous studies have integrated many different variables as outcome variables (e.g. psychological distress, well-being measures, job satisfaction, cardiovascular and other physiological measures, lifestyle factors) but never perceived stress as measured by the PSM scale (see extensive reviews by De Lange, Taris, Kompier, Houtman, & Bongers, 2003, and Van der Doef & Maes, 1999). Nevertheless, the fact that Psychological demands appears as a major contributor to our health outcome (viz. psychological stress) is consistent with previous studies in which a main effect of this dimension was also reported (De Lange et al., 2003; Van der Doef & Maes, 1999). However, it should be noted that other studies highlighted low ability of psychological demands to predict outcomes in simultaneous association with decision latitude (see Karasek & Theorell, 1990, for details). According to Karasek et al. (1998), this reduced ability could be partly explained by the correlation between psychological demands and decision latitude as well as by the less statistical reliability of the psychological demands

scale. Since our study addressed these two points, it makes sense for the psychological demands factor to be the first predictor of psychological stress. Regarding the significant impact of organizational difficulties on psychological stress, this result is in agreement with previous studies showing that structural changes within organizations lead to increased levels of stress (Hansson et al., 2008; Noblet et al., 2006; Tvedt et al., 2009). We thus claim that this factor can be relevant to consider (in addition to other job stress factors) in future studies focused on health outcomes of organizational changes at work.

One limitation of this study is that it was led in a specific context of organizational change at the university of Strasbourg and with a specific sample consisting of employees of the university. A challenge for future research would be to test whether this five-factor version of the French JCQ applies to other types of organizational change occurring within other institutions like companies. Additionally, it seems important to examine other psychometric properties of this model, like its test-retest reliability or its predictive validity concerning other occupational health variables. Psychological stress was the only outcome measure in this study. It would thus be fruitful to explore the relationship between the five job stress factors and other outcome variables like job/occupational stress, job dissatisfaction, or non-work conflicts (Wong, Lin, Liu, & Wan, 2014). It would also be worth collecting longitudinal data showing consequences of these job stress factors in the long run. This could be achieved by asking again employees to complete the same questionnaire at several points in time in order to see in what extent psychological stress is shifting as a result of shifting levels of stress factors. In the same vein, other ways to test discriminant validity or other aspects of validity (e.g. convergent validity) need to be examined before considering this model as a fully valid scale of stress factors (using for example a multi-trait-multimethod strategy).

5. Conclusion

This study allowed to identify three main job characteristics that are responsible for psychological stress in a context of organizational change: psychological demands, organizational difficulties (related to role ambiguity and communication problems), and supervisor social support. Along with decision latitude and coworker social support, these five dimensions accounted for almost a half of the variability in psychological stress. This study also showed that this five-factor model of the French JCQ is an appropriate tool to measure Demand-Control-Support (and -organizational difficulties) dimensions in a context of organizational change. In doing so, two important issues about the job stress factors as measured by the JCQ has been addressed in this study: (1) the need for improvement of some JCQ scales as requested by authors like Kawakami et al. (1995, p. 371), Niedhammer (2002, p. 143), or De Araujo and Karasek (2008, p. 58); and, (2) the need to investigate the inclusion and the relevance of an organization-level job dimension as a part of an expanded JCQ which as questioned by Karasek et al. (1998, p. 332).

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.erap.2014.09.005>.

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