Journal of Occupational and Organizational Psychology (2007), 80, 647–664

The British Psychological Society

www.bpsjournals.co.uk

A multi-level mediation model of the relationships between team autonomy, individual task design and psychological well-being

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The past decade and a half witnessed a global trend towards the use of participatory team-based interventions. In the present contribution, we address the widespread idea that the resulting increase in team autonomy fosters employee psychological well-being. Specifically, we address the common but mostly implicit rationale for this widespread idea that the well-being effect occurs because the increase in team autonomy is reflected in individual task design. We collected survey data from 733 members of 76 healthcare teams. The results of multi-level mediation analyses were supportive of our theoretical framework. The higher the team autonomy, the more active learning behaviour and the less emotional exhaustion team members reported. These relationships were mediated by the individual job characteristics of autonomy, variety and demands. These results draw attention to individual task design in a team context.

Teamwork is a popular and widespread phenomenon in contemporary work organizations. The implementation of teamwork typically involves a restructuring of responsibilities within the organization to at least some extent. Well-known team-based interventions, such as team empowerment and self-managing teamwork were developed specifically to reshuffle responsibilities by increasing autonomy at the level of the work team (Cordery, 1996; Kirkman & Rosen, 1999). Therefore, team autonomy is commonly considered a key characteristic of work teams (e.g. Langfred, 2000; Leach, Wall, Rogelberg, & Jackson, 2005; Van Mierlo, Rutte, Vermunt, Kompier, & Doorewaard, 2006). The past decade and a half witnessed a global trend towards the use of a large variety of participatory team-based interventions that aim at increasing the level of team

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DOI:10.1348/096317907X196886

autonomy (Leach *et al.*, 2005). The introduction of such interventions is, to an important extent, based on the assumption that the increased team autonomy will promote both organizational effectiveness and individual psychological well-being (e.g. Goodman, Devadas, & Hughson, 1988; Guzzo & Dickson, 1996; Langfred, 2000; Sonnentag, 1996; Sundstrom, De Meuse, & Futrell, 1990).

However, a recent review of the literature (Van Mierlo, Rutte, Kompier, & Doorewaard, 2005) suggests that research in the area of teamwork and psychological well-being has not kept pace with the increasing prevalence of relatively autonomous teams. Results of previous studies were not entirely consistent, the mechanisms underlying the potential relationship between team autonomy and individual psychological well-being remain unaddressed and the inherent multi-level nature of this relationship received little attention. We argue that more detailed knowledge of the relationship between team autonomy and individual psychological well-being is needed to advance theory building on the individual psychological impact of teamwork. In addition, such knowledge could represent an important contribution to organizational practice by offering suggestions as to how to design and implement teams in a way that promotes the psychological well-being of team members. In the present contribution, we therefore examine the relationship between team autonomy and individual psychological well-being and explore how this relationship comes about, taking a multi-level job design perspective.

Team autonomy and individual psychological well-being: A job design perspective

Although previous findings were not always entirely consistent, the existing body of research does suggest a positive relationship between team autonomy and various indicators of psychological well-being. Authors have related team autonomy to improved quality of work life (Cohen, Ledford, & Spreitzer, 1996; Spreitzer, Cohen, & Ledford, 1999), increased work motivation (Janz, 1999; Janz, Colquitt, & Noe, 1997), increased job satisfaction (Janz, 1999), reduced psychological fatigue (Van Mierlo, Rutte, Kompier, & Seinen, 2001), job strain (Leach *et al.*, 2005) and reduced absenteeism (Cohen *et al.*, 1996). In general, authors do not explain in much detail how they expect this relationship to come about. Close examination of this literature shows that the prevalent, albeit implicit, assumption is that team autonomy is transferred to the individuals in the team, thus affecting individual job characteristics (Van Mierlo *et al.*, 2005). Individual job characteristics, in turn, are known to be well-established predictors of a wide array of individual psychological outcomes (e.g. Kompier, 2003; Sparks, Faragher, & Cooper, 2001; Troup & Dewe, 2002). In summary, the prevailing line of reasoning is that the team autonomy is positively related to individual psychological well-being and that this relationship can be attributed to improved individual job characteristics.

This line of reasoning implies an explicit multi-level approach of the relationship between team autonomy and psychological well-being. On the one hand, when increasing team autonomy, the emphasis is on the team as a whole, as is illustrated, for example, by the pronounced team level model of team empowerment presented by Kirkman and Rosen (1999), or by the consistent team level framing of studies of self-managing teamwork and psychological well-being (Van Mierlo *et al.*, 2005). Psychological well-being, on the other hand, is in its very nature an individual experience. It is the individual who is satisfied with his or her job or who experiences tension or fatigue (Sonnentag, 1996).

This multi-level perspective received little attention in previous studies of teamwork and psychological well-being.[1] Therefore, in the present contribution, we aim at integrating the team and individual level perspective by proposing a multi-level framework for studying the relationship between team autonomy, individual job characteristics and individual psychological well-being. The framework is displayed in Figure 1 (a detailed explanation of the B-coefficients will be provided in the method section). Our core proposition is that the relationship between team autonomy and individual psychological well-being is mediated by individual job characteristics. In addition to individual task design, there may well be additional mechanisms at play, related, for example, to social process factors. The conceptual framework for the present study accounts for such additional mechanisms by the inclusion of a direct relationship between team autonomy and psychological well-being (B_{c1} and B_{c2} in Figure 1). Our current focus on the role of individual task design is based on the observation that improved individual task design is the prevailing argumentation for authors to presume a positive relationship between team autonomy and individual psychological well-being. We will now turn to a discussion of the framework in Figure 1 and the proposed relationships.

Team autonomy and individual task characteristics

Team autonomy is a key characteristic of work teams that refers to the degree to which the team task provides the team with substantial freedom, independence and discretion in scheduling the work, and in determining the procedures to be used in carrying it out (Cordery, Mueller, & Smith, 1991; Hackman, 1987; Kirkman & Rosen, 1999; Langfred, 2000). As Hackman puts it, in case of high team autonomy 'the group owns the task'.

The individual task characteristics included in our framework are individual autonomy, individual task variety and individual job demands. All three are tightly embedded in the individual psychological well-being literature, most notably in the influential Job Demand Control Model (JDC-model, Karasek, 1979, 1998). At the same time, as we will explain below, all the three characteristics may be expected to relate to team autonomy.

Individual autonomy refers to the freedom, independence and discretion in the individual job and is a core feature of practically all individual task design theories and a well-established predictor of individual well-being (Hackman & Oldham, 1975, 1980; Karasek, 1998; Kompier, 2003). For the purpose of the present study, it is important to note that team and individual autonomy are distinct constructs. Team autonomy refers to the level of the work team, and has no meaningful existence at the individual level, while individual autonomy exists at the level of the individual employee. As the importance of issues of the level of analysis is gaining recognition, several researchers have emphasized that autonomy simultaneously resides at the level of the work team and that of the individual employee (Langfred, 2000; Van Mierlo *et al.*, 2005). The implicit assumption in studies on team autonomy and psychological well-being that the autonomy at the team level is transferred to the jobs of the individual team members suggests a positive relationship between team and individual autonomy. To our knowledge, two previous studies addressed this relationship, and both indeed found a

[1] *To our knowledge, only one previous study specifically addressed the relationship between team autonomy and psychological well-being, proposing and demonstrating that this relationship was mediated by individual task design (Van Mierlo* et al.*, 2001). This study too took a single-level approach, measuring and analyzing all variables at the individual level.*

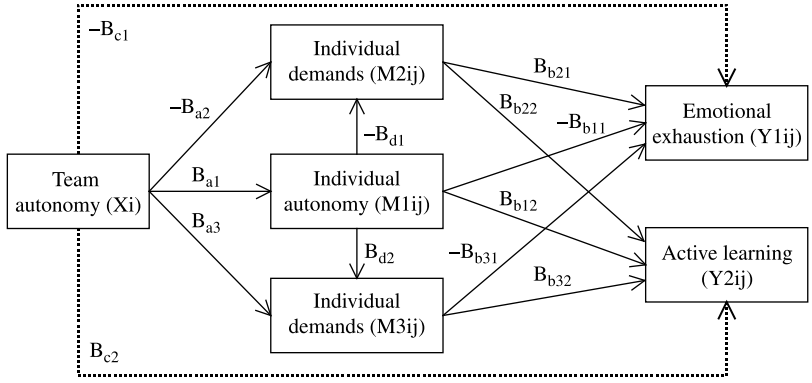

Figure 1. Detailed model of the mediated relationship between team autonomy and psychological well-being.

positive relationship (Van Mierlo *et al.*, 2001, 2006). As such, we expect high autonomy at the team level to be related to the latitude that individual members experience in their own jobs (B_{a1} in Figure 1).

We also expect team autonomy to relate to individual task demands and variety. High team autonomy allows a team to distribute tasks equally among team members, to rearrange tasks if necessary, and to support each other when needed, directly resulting in decreased individual demands (B_{a2} in Figure 1). In addition, team autonomy will typically enrich the scope of the team task, adding additional tasks and responsibilities (e.g. in the domain of administration, decision-making and planning) that team members will have to cope with one way or the other, resulting in a direct increase in individual task variety (B_{a3} in Figure 1). Besides these direct links, we expect an additional indirect relationship between team autonomy and individual demands and task variety mediated by individual autonomy (displayed in Figure 1 by B_{d1} and B_{d2}). The larger the extent to which team autonomy is transferred to the task of an individual team member, the more additional tasks he or she will be performing, and the more options this person will have to regulate his or her own individual demands.

Individual task design and psychological well-being

The relationship between individual task design and psychological well-being has been studied extensively. We will therefore confine our discussion to a brief overview of how we expect the three individual task features (autonomy, variety and demands) to relate to psychological well-being, expectations that follow directly from the JDC-model. More detailed information can be found in one of the reviews on this subject (e.g. De Lange, Taris, Kompier, Houtman, & Bongers, 2003; Van der Doef & Maes, 1999). The JDC-model proposes two distinct hypotheses: The 'strain' and the 'active learning' hypothesis. The strain hypothesis defines psychological well-being in terms of the absence of negative symptoms (i.e. psychological strain). Based on this hypothesis, we expect that individual autonomy and variety will be negatively, and individual demands positively related to psychological strain. That is, we expect high levels of autonomy and variety to coincide with low levels of strain and high levels of demands with high levels of strain (B_{b11}, B_{b21} and B_{b31} in Figure 1; in the figure, psychological strain is represented by emotional exhaustion). The active learning hypothesis defines psychological well-being

in terms of the presence of positive symptoms (i.e. active learning behaviour). Based on this hypothesis, we expect that autonomy, variety and demands will be positively related to active learning behaviour,[2] as displayed by B_{b12}, B_{b22} and B_{b32} in Figure 1.

Next, we present an empirical analysis of this proposed multi-level mediation model, providing a detailed analysis of the as yet largely unexplored relationship between team level autonomy and individual psychological well-being.

Method

Sample

Data for this study were collected in two domiciliary care organizations and three nursing homes in The Netherlands.[3] All organizations employed team-based work, which they themselves referred to as self-managing teamwork. The teams in these organizations were clearly recognizable work units that were generally, as a collective, responsible for the care of all clients in a specific area or ward. Most teams had considerable autonomy with regard to the organization of their work, although we still encountered substantial variety in the distribution of decision authority between teams and their management. Team members met regularly, and often had been trained in, for example, work planning systems or communication skills.

We distributed self-administered surveys among all 1195 members of 80 self-managing teams. The surveys were filled out individually, during team meetings. We received completed surveys from 753 team members, representing an average response rate of 63%. We excluded two teams from our sample because of a large number of missing values, and two others because only one team member responded to the survey. The final sample consisted of 733 members of 76 teams. The average number of respondents per team was 9.64 ($SD = 5.12$). The majority of respondents were female (93%) and the average age was 41 years ($SD = 10.62$). Our contact persons within each organization compared the demographic characteristics of our sample with those of their entire organization and, without exception, concluded that respondents did not differ from the total population with regard to factors such as age, tenure and sex.

Measures

Individual task characteristics

Individual autonomy, demands and variety were measured with the corresponding scales from the Dutch Questionnaire on the Experience and Evaluation of Work (VBBA), a survey instrument that is widely used in The Netherlands to evaluate the work situation of individual employees. Previous research demonstrated the excellent psychometric properties of this instrument in terms of reliability and validity (Van Veldhoven, De Jonge, Broersen, Kompier, & Meijman, 2002). The items were answered on four-point response scales, ranging from 0, 'never' to 3, 'all the time'. Individual

[2] *Stress researchers differ in their interpretation of the JDC-hypotheses. While many stress researchers assumed additive effects of control and demands on strain and learning (control reduces strain and increases learning, while demands increase both strain and learning), others assumed an interactive effect (control buffers the negative effects of high demands). Since both theoretical and empirical evidence is considerably more supportive of the additive effect (*De Lange et al.*, 2003; Taris, 2006), we adhere to the additive interpretation.*

[3] *These data were part of a larger dataset. Other parts of this dataset might be published elsewhere.*

autonomy was assessed with 11 items, asking respondents to indicate the extent to which they could control their work situation, for example 'can you influence your work pace?' (Cronbach's $\alpha = .86$). Individual demands were also assessed with 11 items, asking respondents to evaluate the required pace and quantity of their work, for example, 'Do you work under time pressure?' ($\alpha = .88$). Individual variety was assessed with six items, asking respondents to indicate the extent to which their work required the use of different skills and talents, for example 'Is your work varied?' ($\alpha = .77$).

Team autonomy

While we defined team autonomy as a team level construct, it was not feasible to measure it directly at the team level. Supervisor judgments of team autonomy could not be used, since many teams had no direct supervisor, and in light of the large sample and the geographical dispersion of respondents, observational methods were unachievable. As an alternative, we asked individual team members to assess the autonomy of their team, and averaged these assessments to compose a team level construct. In Chan's (1998) typology of composition models, this method is referred to as 'referent-shift composition'. Consistent with our definition of team autonomy as the team level parallel of individual autonomy, we derived our measure of team autonomy by rephrasing the items of the individual-autonomy measure to have them refer to the team task instead of to respondent's own individual jobs. For example: 'can your team influence its work pace?'. These individual assessments of team autonomy were then aggregated to the level of the work team.

The appropriateness of this procedure depends on the extent to which team members can indeed be characterized as a whole (Chan, 1998). To verify if team members in our sample agreed to a substantial extent on the autonomy of their team, we examined several indicators of within group consensus: the $r_{wg(J)}$-index of within-group agreement (James, Demaree, & Wolf, 1984), the intra-class correlation coefficients ICC1 (Bliese, 2000; Bryk & Raudenbush, 1982) and ICC2 (Bartko, 1976; Bliese, 2000). The $r_{wg(J)}$-values for our measure of team autonomy were high, with an average value of .95, indicating substantial agreement among team members. ICC1 was .13, indicating that group membership explained a substantial part of the variance in the responses (Bliese, 2000; Snijders & Bosker, 1999). ICC2 was .71, indicating acceptable reliability of the group means (Klein & Kozlowski, 2000). Together, these indices provided sufficient justification for aggregation of individual responses to the team level.

Psychological well-being

We measured psychological strain with the 'emotional exhaustion'--subscale of the Dutch version of the Maslach Burnout Inventory (MBI; Maslach & Jackson, 1981). The psychometric properties of this version are similar to those of the original American version (Maslach, Schaufeli, & Leiter, 2001). Emotional exhaustion is generally considered the core symptom of burnout (Densten, 2001) and is a common outcome variable in studies on the strain hypothesis of the JDC-model (Van der Doef & Maes, 1999). The scale consists of five items, for example 'I feel mentally exhausted by my work' ($\alpha = .83$).

Active learning can be defined as 'an environmentally facilitated active approach towards learning new behaviour patterns or solving new problems' (Karasek & Theorell, 1990; Taris & Kompier, 2005). So defined, the construct is distinct from related

concepts such as performance or motivation. We measured active learning with a 12-item scale, developed specifically to capture the active learning dimension of the JDC-model. This scale represents an extended version of the four-item scale used in Van Mierlo *et al.*, 2001.[4] Items were, for example, 'In my work I approach problems as puzzles that can be solved', 'In my work I am challenged by new problems', 'In my work I have the opportunity to further develop myself' and 'In my work I am the one, who comes up with new ideas' ($\alpha = .83$).[5]

Table 1 presents *individual-level* scale scores, S.D.s, reliability coefficients and correlation coefficients for all measures in our study.

Table 1. Scale scores, SDs, reliability and correlation coefficients of all variables

	Sca	*M*	*SD*	1	2	3	4	5	6
Team autonomy[1]	0–3	1.69	0.22	(.94)					
Ind. autonomy	0–3	1.64	0.48	.50**	(.86)				
Ind. demands	0–3	1.36	0.43	−.13**	−.20**	(.88)			
Ind. variety	0–3	1.75	0.49	.12**	.22**	.08**	(.77)		
Exhaustion	0–6	1.44	1.00	−.14**	−.22**	.46**	−.05	(.83)	
Active learning	0–3	1.36	0.38	.15**	.20**	.12**	.54**	−.07	(.83)

[1] The statistics in this table are based on the individual-level data. Scale reliabilities (α) are displayed between parentheses on the diagonal.
Ind. = individual; Sca = scale range; *M* = mean; *SD*= standard deviation
**$p < .01$; $N = 733$.

Analysis

Discriminant validity

We used similar items to measure team and individual autonomy, which might result in poor discriminant validity. To verify whether *individual* respondents had been able to differentiate between team and individual autonomy, we employed confirmatory factor analysis (CFA) using LISREL 8.30 (Jöreskog & Sörbom, 1993). In case of two distinct constructs, a two-factor model should fit our data better than a one-factor model. To compare the models, we used a Difference Chi-square-test (Bollen, 1989), and the AIC-fit measure (Akaike, 1987). To assess if team and individual autonomy were distinct at the *team* level, we used principal component analysis (PCA) on the aggregated data, because of the relatively small sample size ($N = 76$). If team and individual autonomy are distinct, PCA should yield a two-factor solution. A final indication of the discriminant validity of team and individual autonomy is provided by their correlation, both at the team and individual level. A correlation above .85 would suggest poor discriminant validity (Kenny, 1998).

Multi-level mediation

Our hypotheses involved multiple levels of analysis and could not be adequately addressed by single-level analyses. Moreover, traditional single-level mediation analyses (Baron & Kenny, 1986) on nested data might produce biased standard errors

[4] *In Van Mierlo* et al. *(2001), the scale was referred to as 'motivation to learn'. Given the consistent labelling of the positive JDC-dimension as the 'active learning hypothesis', the label of 'active learning' seems more appropriate.*
[5] *The original items are available from the first author on request.*

(Krull & MacKinnon, 2001). We therefore used multi-level regression procedures for assessing mediated relationships. Because multi-level mediation models are still relatively uncommon in the domain of organizational psychology, a detailed overview of our analysis procedure is presented in the Appendix.

The multi-level mediation model for our study is displayed in Figure 1. In the figure, the coefficients representing the relationship between team autonomy and the mediators are marked with the subscript 'a', those representing the relationship between mediators and both indicators of psychological well-being with 'b', and those representing the relationships among the mediators with 'd'. The direct relationship between team autonomy and well-being is marked with 'c'. The relationships in Figure 1 were estimated with a number of separate regression equations, based on the procedure proposed by Krull and MacKinnon (2001). The regression equations were estimated using MLwiN (version 1.10.0007), a specialized statistical package for multi-level modelling (Rasbash, Browne, Goldstein *et al.*, 2000).

Differences between organizations

The teams in our sample were nested in five different organizations. Organizational membership might explain part of the variation in individual and team characteristics. In that case, organizational membership should be controlled for in our analyses. We thus examined ICC (1) values for organizational membership for both dependent variables. ICC (1) for active learning was .00 ($p = .27$) and ICC (1) for emotional exhaustion was .01 ($p = .46$). Given that both values are small and non-significant, we did not further consider the impact of organizational membership in our analyses.

Results

Discriminant validity

The fit indices for the one- and two-factor CFA models of autonomy are presented in Table 2. This CFA was performed on the individual responses to the items for team and individual autonomy ($N = 733$).

Table 2. Goodness-of-fit-measures for a one- and a two-factor CFA model of team and individual autonomy

Model	χ^2	*df*	*p*	RMSEA	AIC	CFI
Autonomy						
One-factor	2931.88	196	.00	.14	3045.88	.90
Two-factor	1060.60	195	.00	.08	1176.60	.95
Difference	1871.28**	1	.00			

**$p < .01$; $N = 733$

The two-factor model, where the items for team autonomy load on the first factor and the items for individual autonomy on the second, fitted our data significantly better than the one-factor model ($\triangle\chi^2 = 1871.28$, $df = 1$, $p < .00$). The AIC-value was also lower for the two-factor model. The Principal Component Analysis (PCA) on the aggregated data ($N = 76$) yielded a two-component solution in which all items for individual autonomy loaded on the first component (eigenvalue = 9.26, explained

variance = 42.08%), while all items for team autonomy loaded on the second (eigenvalue = 2.91, explained variance = 13.28%). At the individual level, the correlation between team and individual autonomy was .50. At the team level, using the aggregated responses, this correlation was .58. These correlations indicated satisfactory discriminant validity at both levels (Kenny, 1998). Altogether, we conclude that we are dealing with two related, but clearly distinct constructs, both at the individual and at the aggregated (team) level.

Multi-level mediation

To estimate the mediated relationships in the model, we first regressed each mediator (M_{ij}) separately on team autonomy (X_j; e.g. $M1_{ij} = B_{01} + B_{a1}X_j + r_{ij1} + u_{0j1}$). Next, we regressed the criterion variable (Y_{ij}; cf. exhaustion or active learning) on team autonomy and the three mediators simultaneously ($Y_{ij} = B_{1oY} + B_{c1}X_j + B_{b11}M1_{ij} + B_{b21}M2_{ij} + B_{b31}M3_{ij} + r_{1ijY} + u_{1ojY}$). Mediation is implied if both B_a and B_b are significant, that is, if team autonomy is significantly related to the mediator *and* the mediator is significantly related to the criterion. The mediated contribution is defined as the product of B_a and B_b (Figure 1 displays all coefficients and symbols; a more detailed overview of the analysis procedure is provided in the Appendix).

Table 3 displays standardized B-coefficients for our complete research model.

The first step, regressing each mediator separately and directly on team autonomy, yielded standardized B_a-estimates of .29 ($p < .01$) for individual autonomy, $-.16$ ($p < .01$) for individual demands and .11 ($p < .05$) for individual variety (unidirectional tests). As we expected, these results suggest that team autonomy was positively related to individual autonomy and variety and negatively to individual demands.

Next, in a single regression equation, we estimated the relationship between individual autonomy, demands and variety on the one hand and emotional exhaustion on the other hand. Estimates for the standardized B_b coefficients were $-.12$ ($p < .01$) for individual autonomy, .43 ($p < .01$) for individual demands and $-.05$ ($p > .10$) for individual variety. As proposed, these results suggest a moderate negative relationship between individual autonomy and emotional exhaustion, and a strong positive relationship between individual demands and emotional exhaustion. Results do not support the proposed negative relationship between individual variety and emotional exhaustion.

Repeating this procedure with active learning as the criterion variable yielded standardized B_b-estimates of .09 ($p < .01$) for individual autonomy, .11 ($p < .01$) for individual demands and .50 ($p < .01$) for individual variety, indicating a strong positive relationship between individual variety and active learning, and a somewhat smaller positive relationship between individual demands and autonomy and active learning.

Finally, we assessed whether *individual* autonomy mediates the relationship between team autonomy and individual demands and variety. To this end, we added individual autonomy as a predictor to the regression of individual demands on team autonomy, and to the regression of individual variety on team autonomy, thus obtaining estimates for B_{d1} and B_{d2} in Figure 1. As expected, individual autonomy was negatively related to individual demands ($B_{d1} = -.18$; $p < .01$) and positively to individual variety ($B_{d2} = .24$; $p < .01$). After controlling for individual autonomy, team autonomy was still significantly related to individual demands ($B_{a2'} = -.11$; $p < .05$), but the direct relationship between team autonomy and individual variety was no longer significant ($B_{a3'} = .04$; $p > .10$).

Table 3. Standardized B-coefficients and explained variance for all estimated relationships

		Dependent variable						
Independent variable	*N*	Ind. autonomy	Ind. demands	Ind. demands	Ind. variety	Ind. variety	Exhaustion	Learning
Team autonomy	76	.29**	− .16**	−.11*	.11*	.04	−.06	.09*
Individual autonomy	733	–	–	−.18**	–	.24**	−.12**	.09**
Individual demands	733	–	–	–	–	–	.43**	.11**
Individual variety	733	–	–	–	–	–	−.05	.50**
R^2 team		42%	13%	13%	1%	1%	99%	80%
R^2 Individual		–	–	3%	–	6%	20%	29%

**$p < .01$; *$p < .05$; Ind. = Individual.

Together, these results suggest a pattern of mediated relationships, as displayed in Figure 2.[6]

As can be seen in Figure 2, the relationship between team autonomy and emotional exhaustion was mediated by the autonomy and demands in the individual task. Individual autonomy, in turn, was related to emotional exhaustion, both directly and indirectly, through a relationship with individual demands. Individual variety related neither to team autonomy nor to emotional exhaustion. We can now estimate the total mediated contribution by multiplying all B-estimates involved in each mediated relationship and then summing the products over all mediated relationships. With regard to emotional exhaustion, the total mediated contribution of individual autonomy equalled $(B_{a1} * B_{b11}) + (B_{a1} * B_{d1} * B_{b21}) + (B_{a1} * B_{d2} * B_{b31}) = -.06$, and that of individual demands $B_{a2} * B_{b21} = -.05$, yielding a total mediated contribution of $-.11$.

In the relationship between team autonomy and active learning, individual autonomy also emerged as the principal mediator. Autonomy in the individual task was related to active learning both directly and indirectly, through its relationship with individual variety and demands. With regard to active learning, the mediated contribution equalled $(B_{a1} * B_{b12}) + (B_{a1} * B_{d1} * B_{b22}) + (B_{a1} * B_{d2} * B_{b32}) = .06$ for individual autonomy, $B_{a3} * B_{b32} = .02$ for individual variety and $B_{a2} * B_{b22} = -.01$ for individual demands, yielding an overall mediated contribution of .07.

With regard to the direct relationship between team autonomy and psychological well-being, Figure 2 shows that, after introducing the mediators into the model, team autonomy was no longer significantly related to emotional exhaustion, whereas its relationship with active learning remained significant. These results suggest that the individual task characteristics fully mediated the relationship between team autonomy and emotional exhaustion, but only partially mediated the relationship between team autonomy and active learning.

Concluding, our results suggest that team autonomy is indeed related to individual psychological well-being through a relationship with individual task design. The relationship between team autonomy and emotional exhaustion was fully mediated by individual autonomy, demands and variety, while partial mediation was implied for the relationship between team autonomy and active learning. Individual autonomy emerged as an important individual task attribute, acting as a mediator in the relationship between team autonomy and individual variety and demands.

Discussion

In this study, we attempted to bridge the gap between previous research on team autonomy and research on individual psychological well-being. We examined the proposition that team autonomy is indirectly related to the psychological well-being of team members, through a relationship with the characteristics of their individual tasks.

In line with our expectations, the results of our study indicate that the relationship between team autonomy and individual emotional exhaustion was indeed mediated by individual task design. Autonomy and demands in the individual task appeared to be the central individual task characteristics in this respect: the relationship between team autonomy and emotional exhaustion was fully mediated by individual autonomy and

[6] *All beta-coefficients are combined into a single model to provide a complete image.*

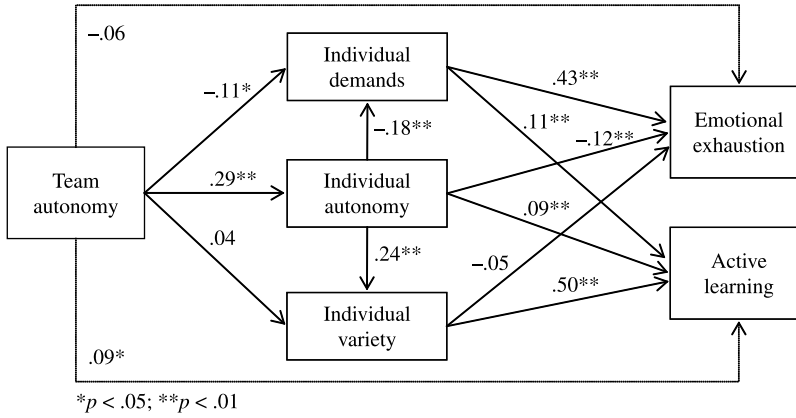

Figure 2. Path diagram with standardized B-coefficients.

demands. Contrary to our expectations, individual variety was not significantly related to either team autonomy or emotional exhaustion.

Also in line with our expectations, the relationship between team autonomy and active learning was mediated by individual task design. Again, individual autonomy and demands were the principal individual design factors: Statistically, the indirect relationship between team autonomy and active learning was entirely accounted for by individual autonomy and demands. Individual variety was also related to active learning, but related to team autonomy only indirectly, through its connection with individual autonomy.

From this complex pattern of relationships we derive a number of more general conclusions and implications. In the first place, the relationship between team autonomy and emotional exhaustion was fully mediated by individual task design, while only partial mediation was established for active learning. Apparently, individual task design is not the only way in which team task autonomy encourages an active learning attitude in individual employees. Perhaps to some extent, increased autonomy and responsibilities at the level of the work team incite curiosity, and encourage team members to adopt an active attitude and keep up with current developments in their team, independent of the attributes of their own individual task. In this scenario, team members would also be activated or motivated by the mere presence of increased responsibility for their work team and by seeing others deal with new tasks and new responsibilities. It seems less likely that team members would feel exhausted by seeing others struggle. Put differently, we propose that an active learning attitude may be incited by factors that either do or do not directly concern the individual, while emotional exhaustion may be more exclusively related to factors that are of direct concern to the individual.

In the second place, in the present study, individual task autonomy and the demands put on individual employees emerged as key task characteristics with regard to the psychological well-being of employees in a team context.

In the third place, for team autonomy to affect the psychological well-being of team members through increased individual variety and decreased individual demands, this team autonomy would need to be incorporated into the individual work of team members. This is especially important with regard to individual variety, since the relationship between team autonomy and individual variety was fully mediated by individual autonomy.

In the fourth place, the overall strength of the mediated relationships was rather modest. This is not surprising, considering that the relationship between team autonomy and the two indicators of psychological well-being was only moderate to begin with. As such, the results of our study are in line with the postulated positive effects of team autonomy on individual psychological well-being that are so commonly assumed, by researchers and practitioners alike. At the same time, the results indicate that the proportion of variance in psychological well-being that is explained by team autonomy is limited. If the primary goal is to increase individual psychological well-being, other more specific interventions may be more effective than increasing team autonomy.

Finally, relationships between individual task characteristics and psychological well-being were in line with both the strain and the activation hypothesis of the Job-Demand-Control-model (Karasek, 1979). Psychological strain as operationalized by emotional exhaustion was related to low individual autonomy and high demands, while active learning was related to high autonomy and high demands.

Our study is not without limitations. We will discuss the most important limitations and examine how they may affect our results and conclusions.

Generalizability

Our sample consisted exclusively of teams in a healthcare setting, where the majority of respondents were female. Results should therefore not automatically be generalized to other organizational settings.

Causal inferences

All data for our study were gathered at the same moment. A well-known limitation of cross-sectional data is that it does not allow one to demonstrate causal relationships. As such, we cannot exclude the possibility that it is in fact an active learning attitude that leads to increased autonomy for individual employees, or that stress complaints colour employee perceptions of their work situation, leading them to report relatively high demands and low autonomy and variety. We should therefore be cautious in making causal inferences from our data. However, our theoretical framework is solidly embedded in theory. Moreover, previous research provided some indication that the effect of task design on psychological well-being may be much stronger than vice versa (De Jonge *et al.*, 2001; De Lange, Taris, Kompier, Houtman, & Bongers, 2004). It thus seems likely that the established relationships are indeed in the predicted direction. To be able to explore this line of argumentation, future studies should employ thorough longitudinal designs (Taris & Kompier, 2003).

Common method variance

A final limitation of our study lays in the use of self-reported data, obtained from a single questionnaire. This procedure may be sensitive to common method bias, occurring when (part of the) variance is attributable to the measurement method rather than to the constructs of interest (Lindell & Whitney, 2001; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). A number of factors in the design of our questionnaire and in the structure of our data reduce the risk of common method bias undermining our study results (Podsakoff *et al.*, 2003). All measures were derived from established instruments with good psychometric properties and in our questionnaire, the items for individual task design, team autonomy and psychological well-being had different scale anchors

and were printed on different pages. In addition to the design of our study, our data also suggest that common method bias may be limited. The results of our confirmatory factor analysis suggest that team and individual autonomy represented distinct constructs. In case of pronounced common method bias, we would expect CFA to yield a 'common method factor'. Results did not in any way suggest the existence of such common method factor. Furthermore, the relationships between the constructs in our study considerably varied in strength, a finding that would be unlikely if a large proportion of variance would be attributable to a stable method factor.

To some extent, we find these observations reassuring (see also Spector, 2006). Still, it is impossible to entirely rule out the possibility that our results are affected by sources of method variance. For practical and financial reasons, it is a major challenge in-group research to use alternative methods of data collection (e.g. observation or interviews). Nonetheless, future studies would gain from the incorporation of such methods (see also Semmer, Grebner, & Elfering, 2004).

Despite these limitations, we feel our design does have its merits. We achieved a large sample size. In addition, our study is one of few to include measures of both team and individual task characteristics. Moreover, our study is one of the first studies in the domain of group research to present a multi-level analysis of a complex mediation model.

To our knowledge, the process through which team autonomy may affect individual psychological well-being has not been empirically addressed before. Also, the distinction between the characteristics of the team task and the task of individual team members has largely been neglected in the literature on groups and teams. We argue that the isolated study of either team or individual task design does not suffice to understand how teamwork may affect psychological well-being. To gain insight into this process, a multi-level approach is required. Moreover, our results indicate that applying task design theories such as the Job-Demand-Control Model (Karasek, 1979, 1998) to the team level may influence the meaning of the relevant constructs and the effects that may be expected. Before making this shift to the team level, one should carefully consider possible theoretical and methodological consequences.

Since team and individual task characteristics have hardly ever been examined simultaneously, we have little knowledge of the factors that may determine whether or not characteristics of the team task are incorporated into the individual tasks of team members. It is important that such factors are identified in future research, since they may be crucial in determining the actual effect of providing a team with considerable autonomy on the psychological well-being of team members. It is our hope that future research will elaborate on the results of our study and produce practical guidelines on how to implement teamwork in such a way that the quality of the organization improves, while at the same time individual team members will benefit.

Acknowledgements

The authors would like to thank Harry Garst for his statistic advice, and colleagues and the anonymous reviewers who have provided valuable comments on earlier drafts of this manuscript.

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Received 31 March 2006; revised version received 12 December 2006

Appendix

Analysis procedure for multi-level mediation with multiple mediators

In our analyses, we built on the work of Krull and MacKinnon (2001), who described a method for assessing multi-level mediation models, derived from the traditional, single-level mediation model (Baron & Kenny, 1986). Single-level mediated effects can be estimated in two different ways. In the first, most common method, the outcome variable is first regressed on the initial variable. In the second step, the mediating variable is added to the regression equation. The mediated effect is defined as the difference between the estimated B-coefficients for the initial variable in the first and second equation. This method, however, provides no information about the relative contribution of multiple mediators to the mediated effect, which is problematic given our conceptual model. Therefore, we used the second method for estimating mediation effects. This method involves a first equation in which the mediator for person i (M_i) is regressed on the initial variable (X_i) : $M_i = B_{oM} + B_aX_i + r_{iM}$, and a second equation in which the outcome (Y_i) is predicted by the initial variable and the mediator (M_i) : $Y_i = B_{oY} + B_{c'}X_i + B_bM_i + r_{iY}$. Mediation is implied if both B_a and B_b are significant, and the mediated effect is defined as the product of B_a and B_b. In single-level analysis, the two methods produce the same overall mediation effect. Krull and MacKinnon demonstrated that these equations can be recast as multi-level equations that can be used to compute multi-level estimates of the mediated effect.

In the present study, we used a multi-level regression equivalent to the second method to determine the mediating roles of individual autonomy, variety and demands separately. Our model is more general than that of Krull and MacKinnon, because it contains multiple mediators (Gully, Frone, & Edwards, 1998). We obtained the

mediating effects B_aB_b from the partial regression coefficients; that is, controlling for the effects of the other mediators on the outcome variable (Cohen & Cohen, 1983, p. 356).

The multi-level mediation model for our study is displayed in Figure 1. Let us say that X_j represents team autonomy, $M1_{ij}$, $M2_{ij}$ and $M3_{ij}$ denote the mediators' individual autonomy, demands and variety, respectively; Y_{ij} refers to the outcomes of interest: emotional exhaustion and active learning. The indices i and j refer to individuals and teams, respectively. The left-hand side of the model consists of three multi-level regression equations in which the mediators are predicted by the initial variable. The equations predicting individual demands and variety were estimated twice, the second time controlling for individual autonomy ($M1_{ij}$):

$$M1_{ij} = B_{01} + B_{a1}X_j + r_{ij1} + u_{0j1} \quad (1)$$

$$M2_{ij} = B_{02} + B_{a2}X_j + r_{ij2} + u_{0j2} \quad (2a)$$

$$M2_{ij} = B_{02} + B_{a2}X_j + B_{d1}M1_{ij} + r_{ij2} + u_{0j2} \quad (2b)$$

$$M3_{ij} = B_{03} + B_{a3}X_j + r_{ij3} + u_{0j3} \quad (3a)$$

$$M3_{ij} = B_{03} + B_{a3}X_j + B_{d2}M1_{ij} + r_{ij3} + u_{0j3} \quad (3b)$$

To examine the right-hand side of the model, we regressed the outcome variable on the initial variable and the three mediators. This equation was estimated separately for emotional exhaustion (4a) and active learning (4b).

$$Y_{ij} = B_{1oY} + B_{c1}X_j + B_{b11}M1_{ij} + B_{b21}M2_{ij} + B_{b31}M3_{ij} + r_{1ijY} + u_{1ojY} \quad (4a)$$

$$Y_{ij} = B_{2oY} + B_{c2}X_j + B_{b12}M1_{ij} + B_{b22}M2_{ij} + B_{b32}M3_{ij} + r_{2ijY} + u_{2ojY} \quad (4b)$$

We labelled the coefficients representing the relationship between team autonomy and the mediators with the subscript 'a', those representing the relationship between mediators and well-being with 'b', and those representing the relationships among the mediators with 'd'. The direct relationship between team autonomy and well-being was labelled with the subscript 'c'. The difference between a standard mediation model and this multi-level model is the presence of the random intercepts u_{0j1}, u_{0j2}, u_{0j3} and u_{0jY}.

Together, the subsequent steps in this analysis address our core assumption that the relationship between team autonomy and psychological well-being is mediated by individual autonomy, variety and demands. Note that, in this method of assessing mediation, the direct relationship between team autonomy and psychological well-being is not estimated separately. The regression equations were estimated using MLwiN (version 1.10.0007), a specialized statistical package for multi-level modelling (Rasbash, Browne, Goldstein *et al.*, 2000).