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Differential Effects of Workplace Stressors on Innovation: An Integrated Perspective of Cybernetics and Coping

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Author Note

Study 1 of this paper is based on a secondary analysis of a larger data collection effort funded by the Mental Health Programme of the NHS Executive (Northern and Yorkshire), UK. Other publications that build upon this data set do not have any substantial overlap with the present paper (Hardy, Shapiro, Haynes, & Rick, 1999; Hardy, Woods, & Wall, 2003; Haynes, Wall, Bolden, Stride, & Rick, 1999; Payne, Wall, Borrill, & Carter, 1999; Wall et al., 1997; Whaley, Morrison, Payne, Fritschi, & Wall, 2005). Data reported in Study 2 have not been included in any previous publication.

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Abstract

It is now consensus that engaging in innovative work behaviours is not restricted to traditional innovation jobs (e.g., research and development), but that they can be performed on a discretionary basis in most of today's jobs. To date, our knowledge on the role of workplace stressors for discretionary innovative behaviour, in particular for innovation implementation is limited. We draw on a cybernetic view as well as on a transactional, coping-based perspective with stress to propose differential effects of stressors on innovation implementation. We propose that work demands have a positive effect on innovation implementation, whereas role-based stressors - i.e., role conflict, role ambiguity, and professional compromise – have a negative effect. We conducted a time-lagged, survey-based study in the health care sector (Study 1, UK: N = 235 nurses). Innovation implementation was measured two years after the assessment of the stressors. Supporting our hypotheses, work demands were positively, role ambiguity and professional compromise negatively related to subsequent innovation implementation. We also tested organizational commitment as a mediator, but there was only partial support for the mediation. To test the generalizability of the findings, we replicated the study (Study 2, Germany: employees from various professions, N = 138, time lag 2 weeks). Again, work demands were positively, role ambiguity and professional compromise negatively related to subsequent innovation implementation. There was no support for strain as a mediator. Our results suggest differential effects of work demands and role stressors on innovation implementation, for which the underlying mechanism still needs to be uncovered.

Keywords: innovation implementation, stressors, innovative work behaviour, cybernetic stress theory

Differential Effects of Workplace Stressors on Innovation: An Integrated Perspective of Cybernetics and Coping

Contemporary organizations are mostly operating in highly demanding environments facing changing technologies, increasing client demands, and high levels of performance pressure. Amongst others, this very well resembles the reality of most health care organizations which have to deal with challenges such as a continuous increase in the number and needs of patients, shortage of qualified medical and nursing staff, as well as insufficient budgeting (McNeely, 2005). System and process innovations are seen as an effective way of dealing with these challenges (West, 2002). Adaptation is not only important at the macro-level, e.g., organization, but also at the micro-level where individuals have to cope with different types of work demands every day. Thus, employees who introduce innovations by changing and improving procedures, products, or processes can be a vital source of effective adaptation to a demanding environment (e.g., Anderson, Potočnik, & Zhou, 2014).

Innovative behaviours can be performed as an expected part of the job (e.g., in Research and Development jobs), but also as extra-role or discretionary behaviours, as would be the case in many front-line services jobs. Those innovative behaviours are adaptive and they have been reported to have a great value for the performance on different organizational levels. Employees' discretionary innovative behaviours have been found to contribute to individual effectiveness (Janssen & Huang, 2008) and unit performance (Fay, Lührmann, & Kohl, 2004), and they have also been proposed to benefit the effectiveness of organizations (Mumford, 2000).While much of the early research was guided by the idea of a "creative personality" and thus focussed on dispositional antecedents of innovative work behaviour (for a review see, for example, Mumford, 2000), results based on a meta-analysis suggest that "of all the predictor categories, job characteristics held the most consistent and strongest positive relationships with creativity and innovation" (Hammond, Neff, Farr, Schwall, & Zhao, 2011, p. 100). There is robust evidence on the innovation-facilitating effect of classic work design

characteristics such as task complexity and job autonomy (e.g., Axtell et al., 2000; Urbach, Fay, & Goral, 2010). In contrast, the present knowledge on the role of workplace stressors for employees' innovative behaviours is limited. Findings are inconsistent with researches reporting positive, negative, and non-significant associations between stressors and innovative work behaviours (e.g., Janssen, 2000; Sacramento, Fay, & West, 2013; Unsworth, Wall, & Carter, 2005; Zhou, 2003). Furthermore, our knowledge on the effect of stressors on the actual implementation of an innovation is particularly limited. This is a critical research gap because occupational stressors are ubiquitous and mostly inevitable facts of organizational life (Örtqvist & Wincent, 2006) and in terms of innovation implementation, only implemented changes have the potential to benefit the individual or organization. It is therefore important to understand if and how stressors affect innovation implementation.

The purpose of the present study is twofold. First, our research shall help to shed light on an inconsistent pattern of stressor – innovation relationships; second, we seek to contribute to our knowledge on the effect of workplace stressors on specifically innovation implementation. To this end, we draw on the cybernetic view of workplace stress and on coping literature derived from the transactional theory of stress to develop differential predictions of workplace stressors' impact on innovation implementation.

Theoretical Background

Innovative work behaviours: Ideation, implementation, and their relationship with stressors

According to West and Farr (1990) innovation refers to "the intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, the organization or wider society." (p. 9). Most frameworks in this field have in common that they distinguish between two types of activities involved in innovation. Ideation (also called idea development or creativity) relates to developing new ideas and

voicing them; innovation implementation subsumes the actual introduction of ideas in the work context (Axtell et al., 2000). The distinction between ideation and implementation is important for two reasons. First, the different stages of the innovation process are related to different antecedents. For example, work factors that were found to support ideation do not necessarily facilitate implementation (Axtell, Holman, & Wall, 2006; Axtell et al., 2000; Clegg, Unsworth, Epitropaki, & Parker, 2002). Second, even though ideation is the pre-requisite to every implementable innovation, ideation should not be equated with implementation because not every idea is actually implemented (Baer, 2012).

Studies on the effect of stressors in this field make either use of this distinction by including separate measures of ideation and implementation (or one of them), or do not consider the distinction and use measures that combine ideation and implementation. We refer to the latter as innovation. Research on the linkage between stressors on the one hand, and ideation, implementation, or innovation on the other has delivered a complex picture.

With regard to ideation, the field is dominated by findings with negative effects of stressors. A meta-analysis of experimental studies suggests that creative performance is impaired by uncontrollable stressors or highly evaluative contexts (Byron, Khazanchi, & Nazarian, 2010); furthermore, 8 out of 9 studies on the effect of time pressure on creative performance resulted in negative effects of time pressure (see Table 1 in Byron et al., 2010). Experimental studies published after the meta-analyses tend to replicate this finding (Roskes, Elliot, Nijstad, & De Dreu, 2013; see main effects in experiments 1 and 2). Similarly, field studies revealed negative effects of job insecurity (Probst, Stewart, Gruys, & Tierney, 2007, Study 2) and time pressure on ideation constructs (Baer & Oldham, 2006); but non-significant and positive effects of time pressure and related stressors (i.e. work load, time demands) have also been reported (Noefer, Stegmaier, Molter, & Sonntag, 2009; Unsworth et al., 2005; Zhang, Bu, & Wee, 2016).

In contrast to this literature, there is a dearth of research for innovation

implementation, and this little research does not yield a conclusive picture. For example, cross sectional studies reported non-significant (Ren & Zhang, 2015) or positive associations (Noefer et al., 2009) of time pressure with innovation implementation. Other types of stressors have so far not been considered.

Turning to research that used measures which combined ideation and implementation (Janssen, 2000; Leung, Huang, Su, & Lu, 2011; Wu, Parker, & de Jong, 2014; Zhou, 2003) in order to gain insights into the stressor – implementation linkage has, unfortunately, its limits. Mixed or combined measures may mask specific stressor – implementation associations, as is suggested by findings that show that predictors of ideation and implementation differ from each other (Hammond et al., 2011). Therefore, the purpose of this research is to shed light on innovation implementation, taking different types of stressors into account. Since the majority of jobs are outside the field of innovation work, we focus on areas where innovation implementation would entail engaging in discretionary work behaviours.

Innovation Implementation as a Means of Coping with Stress

The fact that resources at work such as time and personal energy are limited (Hobfoll, 1989) suggests that work place stressors should decrease innovation implementation. Employees need time and energy to complete their job duties; and stressors consume these resources too. Employees who work in circumstances characterised by taxed resources are less likely to allocate time and energy to behaviours that exceed their role requirements.

In contrast to this assumption, the cybernetic perspective of workplace stressors provides an alternative perspective (Edwards, 1992). This view is based on control theory (Carver & Scheier, 1998), which holds that actions are guided by values and goals, and that the purpose of an activity is to reduce discrepancies between the present goal state and set goals. Workplace stressors can be regarded as barriers to work goal achievement. As such, they highlight a goal-state discrepancy that should be closed (Fay & Sonnentag, 2002), and that indicates a "need to change" (Unsworth et al., 2005, p. 542). This view implies that

encountering workplace stressors can trigger innovative behaviours as a means of proactive coping with stressors by improving aspects of the environment or the self (Aspinwall & Taylor, 1997; Fay, Sonnentag, & Frese, 1998).

However, while the cybernetic perspective implies that any type of stressor could trigger innovative behaviours, the literature on coping suggests taking a more differentiated approach. The transactional theory of stress distinguishes (amongst others) two functions of coping strategies (e.g., Lazarus & Folkman, 1984): Problem-focused coping strategies comprise actions that aim at changing the objective reality around the cause of distress, ideally to avoid the stressors' recurrence. Emotion-focused coping strategies aim at dealing with the stress-related emotions and psychological states rather than the stressor itself. Thus, the former is aligned with the cybernetic perspective because it implies that innovative behaviours are a means of coping with stressors. But not every stressor is likely to evoke a problem-focused strategy. Instead, the appraisal of a stressful encounter is regarded as pivotal to understand the effects of a given stressor (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986; Lazarus & Folkman, 1984). The level to which each coping strategy is used is a function of the individuals' appraisal of their ability to change the stressor or its consequences. Active and problem-focused forms of coping are more strongly employed when a stressor is perceived as changeable; emotion-focused and avoidant forms of coping are more likely if a stressor is perceived as unchangeable by the individual (Folkman et al., 1986).

The notion of changeability in shaping the specific response to a stressor also maps onto the challenge-hindrance stressor framework (e.g., Cavanaugh, Boswell, Roehling, & Boudreau, 2000; LePine, Podsakoff, & LePine, 2005). This framework distinguishes two groups of stressors; Hindrance stressors, e.g., role ambiguity or situational constraints, are adverse circumstances that represent threats to goal attainment. It has been argued that hindrance stressors are typically perceived as rather unchangeable and stable (LePine, LePine, & Jackson, 2004); thus, they should result in emotion-focused or avoidant forms of coping

rather than active, problem-focused coping. Challenge stressors, e.g., workload or time pressure, are proposed to have the potential to bring positive outcomes if they are coped with successfully; they have been proposed to be perceived as changeable and thus should result in problem-focused coping (LePine et al., 2004; LePine et al., 2005).

Even though occupations differ to some extent with regard to the stressors relevant to them, a number of stressors are common to a wide range of jobs. Work demands and role stressors (role conflict, role ambiguity) have been studied in a wide range of jobs (see meta-analyses, Gilboa, Shirom, Fried, & Cooper, 2008; Örtqvist & Wincent, 2006). They are also of relevance in the context of the present study, which is health care (e.g., Freshwater & Cahill, 2010; Glazer & Beehr, 2005; Haynes, Wall, Bolden, Stride, & Rick, 1999; Rizzo, House, & Lirtzman, 1970). Because of its relevance in health care, we also include professional compromise as a further role stressor (Haynes et al., 1999; Rizzo et al., 1970). In the following, we propose that innovation implementation is a likely form of coping with high work demands, but not with the role-based stressors.

Work Demands and Innovation Implementation

High levels of work demands are characterized by a lack of time or other resources to accomplish one's tasks (Haynes et al., 1999). Based on cybernetic and coping theory, we propose that work demands should be conducive to implementing innovation. First, having too high work demands should result in the experience of a goal discrepancy; this should in turn trigger actions the purpose of which is to bring about a change. Second, work demands are considered to be challenging in nature and to be changeable (LePine et al., 2004; LePine et al., 2005). This should result in a coping response that is problem-focused. More specifically, it could increase the likelihood that the individual implements an innovation in order to change the situation; for example by directly targeting the stressor or by modifying the surrounding working circumstances (Fay et al., 1998).

Preliminary support for this notion emerged from qualitative research amongst health

care professionals (Bunce & West, 1994). Innovative behaviours were often a result of dealing with high work demands. In a similar vein, research on proactive behaviours, which are discretionary, self-starting but not necessarily innovative work behaviours, showed that some stressors enhance proactivity (Fay & Sonnentag, 2002).

There are only few quantitative studies on the relationship between work demands and discretionary innovative behaviour (i.e., outside the context of research and development). Studies that applied a specific measure of innovation implementation reported positive associations between time pressure and innovation implementation (Noefer et al., 2009), similar results emerged for combined measures of innovative work behaviour (Janssen, 2000; Unsworth et al., 2005; Wu et al., 2014). Accordingly, we propose:

Hypothesis 1: Work demands are positively related to subsequent innovation implementation.

Role Stressors and Innovation Implementation

Similar to work demands, role stressors should also be felt as working conditions that indicate a "need to change" (Unsworth et al., 2005, p. 542). They are detrimental to job holders' well-being and impair job performance (e.g., Gilboa et al., 2008; Örtqvist & Wincent, 2006). In contrast to work demands, role stressors have been classified as hindrance stressors (Cavanaugh et al., 2000), which are more likely perceived as unchangeable (LePine et al., 2004; LePine et al., 2005). As a consequence, these stressors are less likely to ignite active coping strategies such as implementing innovative ideas. More specifically, role conflict is characterized by facing incompatible expectations to one's work role. In the context of health care, these incompatibilities arise from structural conflicts between administrative and medical hierarchies. Nurses are "the prime example of groups who are caught between the two lines of authority" (Rizzo et al., 1970, p. 152). The specific structures of administrative and medical hierarchies often subject nurses to conflicting demands. For example, an elderly, slightly disoriented patient may have settled down after a few days in a

given room. However, for organizational reasons, the responsible nurse may be asked to move the patient again to a different room or ward. This is likely to result in role conflict for the nurse: In contrast to the organizational demand, a medical or patient-oriented perspective suggests to protect the patient from the stress associated with moving him or her away from the by now accustomed other patients and physical location. In hospitals as well as in other sectors or industries, role conflict is mostly structurally inherent in the organization so that it is unlikely that one individual alone can resolve it by implementing an innovative idea.

Role ambiguity refers to a lack of clarity about one's work role with regard to the duties and authorities related to one's role. Ambiguous expectations often result from the organization's structure (Rizzo et al., 1970) and should thus be perceived as unchangeable.

Professional compromise denotes an intra-role conflict between a job incumbent's personal values or professional standards and their externally defined role expectations (Haynes et al., 1999; Rizzo et al., 1970). In the context of nursing, professionally compromised actions include providing poor-quality care due to time and financial constraints. They cause moral distress in health care professionals (e.g., Freshwater & Cahill, 2010). As the conditions leading to professionally compromised behaviour – low budget-policies in the health care system – cannot be overcome, this is likely to decrease problem focused approaches.

Across the three role stressors we propose that role stressors are experienced as aversive and at the same time unchangeable; this decreases the likelihood that employees invest time and energy in implementing innovations.

Hypothesis 2: Role conflict, role ambiguity, and professional compromise are negatively related to subsequent innovation implementation.

Affective Organizational Commitment as Mediator between Role Stressors and Innovation Implementation

The hypothesis of the negative effect of role stressors on innovative behaviours rests

on the assumption that role stressors are unpleasant and are perceived as unchangeable. Unchangeable stressors have been proposed to instigate passive, emotion-focused coping strategies (Lazarus & Folkman, 1984). One such strategy relates to reducing "the overall importance associated with the discrepancy, making it less central" (Edwards, 1992, p. 254). In an occupational context this involves establishing a cognitive and emotional distance between the self and the source of stress. This experience is captured by reduced organizational commitment (Cook & Wall, 1980).

For example, as the working conditions leading to professionally compromised behaviour cannot be overcome, employees cope with this by distancing themselves from the source of stress, that is, from the organization. Perceiving one's work as morally questionable has been shown to result in organizational and occupational dis-identification (Lai, Chan, & Lam, 2013). This psychological state of withdrawal should in turn, make it less likely that employees invest resources into the organization by innovation implementation.

Similarly, role ambiguity and role conflict are unlikely to be changeable through job incumbents' activities (LePine et al., 2004). Thus, individuals will most likely respond to this by distancing themselves from the organization. Meta-analyses applying the challenge-hindrance framework show that role ambiguity and role conflict (i.e., hindrance stressors) are negatively associated with organizational commitment (Podsakoff, LePine, & LePine, 2007).

Hence, we expect that role stressors (professional compromise, role conflict and ambiguity) result in lower levels of innovation implementation through their detrimental effects on affective organizational commitment. This is aligned with findings that discretionary activities benefit from organizational commitment (Xerri & Brunetto, 2013).

Hypothesis 3: Affective organizational commitment mediates the relationship between role stressors (role conflict, role ambiguity, professional compromise) and innovation implementation. Higher levels of role stressors result in lower levels of affective organizational commitment, which in turn affects innovation implementation.

Study 1: Method

Sample and Procedure

Our hypotheses were tested by means of a secondary analysis of a study conducted in health care (authors concealed to permit anonymous review process). The health care setting is well suitable for this research because staff working in health care demonstrate creative and innovative behaviours (Fay, Borrill, Amir, Haward, & West, 2006; Unsworth et al., 2005; Zhou, 2003, Study 2). Data were collected in 19 National Health Service Trusts operating in England. Data were collected in two waves, with a time lag of two years (1993 and 1995). Ethical approval was granted by the University of Sheffield, UK. At each time point, the aim was to achieve a representative sample of the organizations included. Therefore, at Time 2, the matched sample was deliberately limited to approximately 10% of the total sample.

Using the internal postal system, individuals received individually addressed questionnaires. Questionnaires were marked with a unique identification number which allowed identifying respondents and match questionnaires accordingly. Details of respondents at Time 1 were kept until the administration of the survey at Time 2. After completion of data collection names and other personal details were deleted from the databases.

Respondents belonged to seven different occupational groups. These were nurses, doctors, administrative staff, managers, professions allied to medicine, technical and ancillary staff. To test our hypotheses we focused on the subsample of nurses. This sample is suitable to test the proposed model because first, workload and role stressors have been reported to be particularly prevalent among nurses; second, traditionally innovative behaviours do not belong to their formal work role; and third, it was the biggest occupational group of the sample to which this applies. We included only nurses who were employed on a full time basis (i.e., who were contracted for at least 36 hours per week) and who participated in both measurement waves. The final sample used for the analyses presented here consisted of 235 nurses, working for 17 trusts. At Time 1, the average age of the participants was 38 years (SD

= 9.7); 10% of the sample were male.

Attitudinal reactions as a result of employees' enduring work experiences like organizational commitment typically require time to build up. Therefore, we included commitment assessed at Time 2 to test the proposed effect of stressors on commitment.

Measures

Participants filled out self-report questionnaire measures of work stressors at Time 1, whereas innovation implementation and organizational commitment were assessed at Time 2. Age and gender were included in all analyses as control variables. If not stated otherwise, a Likert-type response format was applied (1 = not at all to 5 = a great deal).

Role ambiguity. Work role ambiguity was measured with a five item role clarity scale (Haynes et al., 1999). A sample item is "I have clear planned goals and objectives" (recoded).

Role conflict. Role conflict was measured by a four-item scale (Haynes et al., 1999). The scale assesses the degree to which employees receive incompatible instructions from other members of an organization; the measurement was designed for use in health care setting. A sample item is "Professionals make conflicting demands of me".

Professional compromise. Professional compromise was measured with four items (Haynes et al., 1999). The scale assesses respondents' experience of violation of central work values. More specifically, items capture "the extent to which individuals believe that staff within the Trust have to compromise professional standards in carrying out their work in order to meet conflicting objectives, such as reducing financial costs and staff levels" (Haynes et al., 1999, p. 262). An exemplary item is "Having to make trade-offs between quality of patient care and cost savings".

Work demands. Work demands (e.g., "I do not have enough time to carry out my work") measure the extent to which individuals feel that they have enough resources (e.g., time, aids or supplies/ means) to accomplish their tasks (six items) (Haynes et al., 1999).

Organizational commitment. Organizational commitment was assessed with six

items of the nine-item scale developed by Cook and Wall (1980). The measure captures individual's organizational identification, involvement, and organizational loyalty. Items were adapted to the healthcare context by replacing the term "organization" with "Trust"; e.g., "I sometimes feel like leaving this Trust for good" (reverse coded). Responses were measured using a 5-point scale ranging from 1 (strongly agree) to 5 (strongly disagree)

Innovation implementation. Five items assessed innovation implementation (West, 1987). Respondents indicated the extent to which they had introduced changes to various aspects of work within the last year. These work aspects were work objectives/ targets, methods to achieve work objectives/ targets, work procedures, information/ record systems and ways of accomplishing objectives/ targets at work. Answers were obtained on a 5-point Likert scale ranging from 1 (not at all) to 5 (to a very great extent).

Data Analysis

To accommodate the multilevel nature of the data, i.e., nurses (Level 1, N = 235) were nested within trusts (Level 2, N = 17), the hypotheses were tested with a multilevel structural equation model (MSEM). We used the software Mplus version 7.3 (Muthén & Muthén, 1998). Parameters were estimated using maximum likelihood estimation method.

Model fit was evaluated by (a) χ^2 , (b) comparative fit index (CFI) and Tucker-Lewis index (TLI), (c) the standardized root mean square residual (SRMR), and (d) root mean square error of approximation (RMSEA). According to the recommendations by Hu and Bentler (1999), we considered good fit to be characterised by CFI and TLI values close to .95 or above, SRMR value of .08 or below, and RMSEA value smaller than .06. To test our hypotheses, we examined the effect of all four stressors on innovation implementation simultaneously. This approach is necessary because, first, the four stressors were at least moderately positively correlated ($r = .35$-$.53$, $p < .01$), second, meta-analyses within the challenge-hindrance stressors framework suggest the existence of suppressor effects (LePine et al., 2005; Podsakoff et al., 2007).

Results

Table 1, bottom triangle, presents means, standard deviations, zero-order correlations, and reliability information of all study variables. We investigated whether systematic within- and between-individual variance existed in the criterion variable innovation implementation by estimating a null model (i.e. without predictors). The analysis revealed that the intra class correlation coefficient (ICC) was small (ICC = .02). The magnitude of the ICC is to be at the lower boundary of what is typically seen in organizational behaviour research (Pearsall, Ellis, & Stein, 2009, p. 361). However, the estimated design effect, which is a function of the ICC and the average cluster size (Satorra & Muthen, 1995), was larger than two. This suggested that clustering in data needs to be taken into account during estimation (Maas & Hox, 2005).

We first tested the hypotheses by estimating multilevel models with random slopes. There was no significant variability in the impact of stressors on innovation implementation across the 17 trusts. Thus, for the sake of model parsimony, we specified only the intercepts as randomly varying.

We conducted a series of confirmatory factor analyses (CFAs) to examine the distinctiveness of the constructs used in this study. First, we tested whether the four work stressors (Time 1), i.e. work demands, role ambiguity, role conflict, and professional compromise, represent different constructs with all items loading on their corresponding factors. Analyses revealed a better model fit for a four-factor model, $\chi^2 = 230$, df = 128, $p < .001$, RMSEA = .06, CFI = .96, TLI = .95, SRMR = .06, than any other (different variations of two- and three-factor) model. A one-factor model had the following fit indices: $\chi^2 = 870.89$, df = 134, $p < .001$, RMSEA = .15, CFI = .68, TLI = .63, SRMR = .11. Factor loadings in the four-factor model were acceptable, ranging between .68 and .85 for work demands, between .58 and .89 for role ambiguity, between .73 and .85 for role conflict, and between .51 and .84 for professional compromise.

We then extended the four-factor measurement model of stressors (assessed at Time 1)

by adding a factor for organizational commitment (six items, Time 2), and a factor for innovation implementation (five items, Time 2) to the model. All items loaded on their corresponding factors; the fit indices were as follows $\chi^2 = 734.59$, df = 390, $p < .001$, RMSEA = .06, CFI = .91, TLI = .90, SRMR = .06.

Before testing the structural model, we made three changes. We removed one item of the role ambiguity scale ("I know that I divided my time properly") because of its low factor loading and a cross-loading (-.40) on the work demands factor. Because of content overlap within the implementation measure, we added a covariance term between the residual errors of the item having introduced "New methods to achieve work targets/ objectives" and the item "New information/ record systems". We proceeded likewise with two items of the work demands scale, because both items refer to a lack of "time" at work ("I do not have enough time to carry out my work" and "I cannot meet all the conflicting demands made on my time at work"). The data fit this model well: $\chi^2 = 561.12$, df = 360, $p < .001$, RMSEA = .05, CFI = .95, TLI = .94, SRMR = .06.

Hypotheses Testing[1]

In order to test the main effects predicted in Hypotheses 1 and 2, the four stressors (Time 1) were modelled as exogenous variables, whereas innovation implementation (Time 2) was modelled as an endogenous variable. The model fit was good, $\chi^2 = 449.46$, df = 272, $p < .001$, RMSEA = .05, CFI = .94, TLI = .94, SRMR = .06. In support of Hypothesis 1, work demands were positively related to innovation implementation ($\beta = .34$, $p < .001$). In partial support of Hypothesis 2, role ambiguity ($\beta = -.33$, $p = .03$) and professional compromise ($\beta = -.31$, $p = .02$) were negatively related to innovation implementation, but role conflict did not

[1] We are aware that multilevel models with a number of level-2 entities smaller than 30 can potentially produce biased parameter estimates (Maas & Hox, 2004). Therefore, we re-ran the SEM analyses ignoring the nested nature of the data. The results revealed identical estimates of both direct and indirect effects. However, standard error estimates were higher in the general analyses. This suggests that the regression coefficients estimated with MLM were trustworthy and had not been biased by cluster size. Moreover, simulation studies showed that the number of clusters had only an inconsiderable effect on the fixed-effect model estimates and that multilevel models with only level-1 predictors can be used reliably even if the number of clusters falls below 15 (see McNeish & Stapleton, 2014, for a review).

have a significant effect (β = -.04, p = .77). The four predictors together explained a significant proportion of the total variance in the criterion variable (R^2 = 9%, p = .01). Completely standardized path coefficients for the structural model are presented in Table 2.

Hypothesis 3 stated that organizational commitment mediates the relationships between role stressors and innovation implementation. This was tested by adding organizational commitment as a mediator into the previous model (see Figure 1) and inspecting whether the indirect effects of the three role stressors on innovation implementation via organizational commitment were significant (Zhao, Lynch, & Chen, 2010). On an exploratory basis, we also included a path from work demands to organizational commitment. The model fit the data well; χ^2 = 671.73, df = 416, p < .001, RMSEA = .05, CFI = .93, TLI = .93, SRMR = .06. The four predictors explained a significant portion of variance in innovation implementation (12.4%, p = .005). Organizational commitment had a substantial positive effect on innovation implementation (β = .20, p = .001). The indirect effect of professional compromise on innovation implementation through organizational commitment was significant (B = -.07, p = .03), whereas the direct effect was reduced, but remained significant (β = -.17, p = .04). However, the indirect effect of role ambiguity on innovation implementation via organizational commitment did not reach conventional levels of significance (B = -.06, p = .09), although the direct effect of role ambiguity on innovation implementation was decreased to marginal levels of significance (β = -.15, p = .06). The indirect effect of role conflict on innovation implementation through organizational commitment was non-significant (B = -.02, p = .40), whereas the direct effect of role conflict on innovation implementation remained almost unchanged (β = -.01, p = .89). Thus, we found partial support for Hypothesis 3.

On an exploratory basis, we tested the indirect effect of work demands on innovation implementation via commitment. This effect was not significant (B = .02, p = .37).

Study 2

We conducted a replication of Study 1, pursuing two goals. First, we wanted to test whether the pattern of stressor – innovation implementation effects would be confined to nursing jobs or whether they would generalize to a broader range of job types. Second, given that we received only partial support for the mediation hypothesis, we reassessed our theoretical approach and considered a strain based view to account for the mediating process.

Job holders experience strains because stressors tax or exceed individual's resources, threaten the achievement of work or other personally relevant goals, or represent otherwise "a discrepancy between an employee's perceived state and desired state, provided that the presence of this discrepancy is considered important by the employee" (p. 245) (Edwards, 1992). Job strains are the psychological, physiological, and behavioural reactions that emerge from exposition to job stressors (French, Caplan, & Harrison, 1982; Jex & Beehr, 1991). We focus here on psychological job strains, the aversive affective and cognitive responses to stressors (Edwards, Caplan, & Van Harrison, 1998).

Psychological strains involve a lack of motivation and energy (Örtqvist & Wincent, 2006). Innovation implementation, however, is an activity that requires the investment of personal energy. Therefore, strain might reduce the likelihood that individuals show discretionary work behaviours (Chang, Johnson, & Yang, 2007). This suggests that strain could act as a mediator (LePine et al., 2005).

To address these two goals, we conducted a study with two measurement waves separated by two weeks in Germany. This implies also a test of whether the pattern of results can be detected at a shorter time lag and in a different culture. Thus, Study 1 and 2 differ in three parameters: job types, culture, and time lag. To avoid changing too many parameters, which could make the interpretation of results difficult, we held characteristics of the sample (with exception of job types) as similar as possible. Only participants who were qualified for their job (i.e., excluding un- or semi-skilled employees), who were employed (i.e., excluding self-employed individuals), and who provided data at both measurement waves were included

in the study. Finally, to focus again on jobs in which innovation implementation would be a discretionary activity, we exclude employees who were in a supervisory position.

Method

We recruited participants through a professional access panel, which invited and compensated the participants. Data were collected November and December 2016 as part of a larger research effort using an on-line questionnaire. According to the standards of the University, the design of this study did not need to ethical approval of the University's committee. Data collected at Time 1 included stressors, strain and innovation implementation, at Time 2, strain and innovation implementation. Measures applied in Study 1 were translated from English to German, back-translated and refined. Where necessary, item wording was adapted to make it applicable to the broader range of job types included in Study 2 (e.g., reference to my "hospital trust" was replaced by "employer" or "organization"). Job strain was assessed with an eight-item strain measure which captures emotional and cognitive job strain (e.g., "From time to time I feel like a bundle of nerves"; response format 1 = strongly disagree to 7 = strongly agree) (Mohr, Müller, Rigotti, Aycan, & Tschan, 2006). This measure has been developed and validated in German, but measurement equivalence has been established for a wide range of languages (see Mohr et al., 2006). We excluded 11 individuals who scored 2 SD below the reference sample (N > 4,500) and are therefore outliers (Mohr, Rigotti, & Müller, 2007). As control variables, we assessed age, gender, job tenure, level of qualification for the current job (1 = university degree or full apprenticeship; 2 = further training), and number of working hours (1 = full time, 2 = more than 20hrs per week).

At Time 1, there were n = 298 respondents who met the criteria for inclusion in terms of job qualification, employment status and job level (non-supervisory). They held jobs in a wide range of industries (e.g., trade and commerce, various services including insurances and financial services, building trades, teaching and education, information technology, police and private security). Data for the Time 2 questionnaire was provided by n = 138 individuals. This

implies a dropout of 53% to Time 2. We compared the dropouts with the non-dropouts with regard to mean values, variances as well as correlations of predictors (i.e., stressors and control variables) on the one hand with mediator (strain) and outcome (innovation implementation) on the other hand. Overall, there was little evidence to suggest that the sample would be unduly distorted because of the dropout.[2]

Results

Analyses were conducted with the software package IBM SPSS Statistics 22. Descriptive data and correlation among study variables are presented in the top half of Table 1. Scale reliabilities were satisfactory (Cronbach's $\alpha \geq .79$, see Table 1). In contrast to Study 1, in which we needed to take the nested nature of the data into account, the design of Study 2 allowed testing the hypotheses with hierarchical multiple regression analyses. In order to test Hypotheses 1 and 2, we first regressed innovation implementation Time 2 on the control variables (Step 1 in Table 3). Then, Step 2 introduced the stressors (Time 1) into the regression equation. They accounted for additional 7% of variance in innovation implementation Time 2 ($p < .05$). The pattern of stressor – innovation implementation relationships was the same as in Study 1. Role ambiguity and professional compromise were negative ($\beta = -.19$ and $-.32$, $p < .05$, respectively), work demands positive ($\beta = .27$, $p = .0504$) predictors of subsequent implementation; role conflict did not have a significant effect.

In order to test strain as a potential mediator, we reran the regression analysis and included strain (Time 1 and 2) in the analyses (Step 2a, Table 3). Even though they accounted for significant variance in innovation implementation ($\Delta R^2 = .04$), the individual regression coefficients did not turn significant, because of their high intercorrelation (see Table 1). Step 3a introduces stressors into the analyses. Results speak against strain as a mediator in the stressor – innovation implementation linkage: Variance explained through stressors remained almost unchanged ($\Delta R^2 = .08$).

[2] A detailed description of the analyses can be obtained from the first author.

The regression analyses reported so far replicate the time lagged analyses conducted in Study 1. A weakness of a lagged analysis is that it can be challenged regarding causal conclusions. Therefore, we re-ran the analyses of Study 2, including Time 1 innovation implementation into the analyses (Step 2b). Innovation implementation Time 1 explained additional 28% of variance in Time 2 innovation ($F = 57.24$, $p < .001$). Stressors included in the analysis in Step 3b explained 2.6% of additional variance, but this failed to reach conventional standards of significance ($p = .25$). The regression coefficients followed the previous pattern, but they were not significant (e.g., role clarity, $p = .12$; professional compromise, $p = .14$, work demands $p = .57$).

Discussion

The aim of the present paper was to test the differential effect of workplace stressors on innovation implementation. We focused on occupational contexts in which innovation is not part of the formal work role. Conceptualizing discretionary innovative behaviours as a form of problem-focused coping, and drawing on cybernetic and transactional stress theories, we developed differential hypotheses on the stressor – innovation implementation linkage.

Supporting Hypothesis 1, work demands were a positive predictor of subsequent innovation implementation in both studies. This result supports the predictions derived from the cybernetic model, in which stressors signal a discrepancy between a desired and an actual state (Edwards, 1992; Fay et al., 1998). Implementing innovations in the work place may be a means to change something about the stressor or the self to reduce this discrepancy, assuming that job holders perceive the stressor as changeable.

Consistently across both studies and in partial support of Hypothesis 2, role ambiguity and professional compromise were negative predictors of subsequent innovation implementation; the effect of role conflict on innovation implementation was not significant. Overall, this pattern is in line with the notion that some stressors are less likely to instigate active coping strategies, i.e., in cybernetic-theory terms trigger a negative feedback loop;

these are stressors that are typically perceived as not changeable (LePine et al., 2004).

Why is role conflict not significantly related to subsequent innovation implementation? We advance three potential explanations for this. First, because the stressors are substantially related amongst each other (Table 1) it may well be that role conflict does not become significant because it is the variance shared with other stressors. To test this, we reran the tests of Hypotheses 2 in both studies with role conflict as a single predictor. Role conflict still did not have a significant effect. A second explanation may be that role conflict is without implications for innovation implementation, because it does not entail any negative consequences for the individual (which would result in the proposed negative effect on innovation). The substantial relationships of role conflict with strain (Study 2; see all correlations in Table 1) contradict this: from the perspective of strain, role conflict does indicate a "need to change". Third, contextual factors may shape the role conflict – innovation relationship. Whereas for some work contexts the cybernetic mechanisms may hold, for other contexts role conflict may reduce the level of innovation implementation. For example, a trustful relationship with supervisor may result in role conflict being appraised as changeable and, as a consequence, addressed with innovation. In contrast, in work contexts not perceived as supportive, role conflict may follow the mechanism proposed in Hypothesis 2. Thus, opposing relationships for different work contexts may have caused the non-significant relationship. Future research may pursue this by searching for moderating variables.

Hypothesis 3 suggested that the negative effect of role ambiguity, conflict and professional compromise on subsequent innovation implementation was mediated by organizational commitment (Study 1). This was based on the assumption that these stressors would be perceived as unchangeable, and thus would enhance the likelihood of distancing oneself from the organization. Our results are, however, not fully conclusive. With regard to the second part of the proposed mediation, affective commitment was indeed substantially positively associated with innovation implementation. (e.g., Xerri & Brunetto, 2013).

However, results of the first part of the mediation are less straightforward: Whereas the indirect (i.e., mediated) effect of professional compromise was significant, the indirect effect of role ambiguity was not significant; at the same time, the negative direct effects of these stressors on innovation implementation after adding the mediator into the model, remained (at least marginally) significant (see Table 2). Thus, while commitment partially showed the proposed effect, the remaining effect of role ambiguity and professional compromise on innovation implementation could not be satisfactorily accounted for affective commitment.

Building on research on work stress and strain, we included strain as an alternative mediator in Study 2. This is based on the observation that stressors produce psychological strain, and that discretionary work activities rely on psychological energies. However, there was no support for psychological strain as a mediating mechanism. Thus, the question of the exact process that links role ambiguity and professional compromise to innovation implementation is still not fully understood. Present findings suggest that strain does not play a role, and voluntary detachment – i.e., level of affective commitment – cannot fully explain the effect. Research on other discretionary work behaviour may be help to gain a better understanding of the underlying process. In terms of motivational factors, individuals' perception of control and their beliefs in their capabilities should be considered as mediators. First, meta-analyses highlighted the importance of job as well as general self-efficacy, and of locus of control for innovative and other discretionary work behaviors (Hammond et al., 2011; Tornau & Frese, 2013). Second, stressors are barriers to goal achievement and may thus be a threat to self-efficacy; longitudinal analyses indicate that stressors reduce the perception of control over time (Vander Elst, Van den Broeck, De Cuyper, & De Witte, 2014). In addition, instead of studying a broad psychological strain variable as a mediator, more specific affective experiences could be taken into consideration. For example, positive affect is a predictor of other discretionary, change oriented behaviours (Fay & Sonnentag, 2012), and positive affect is reduced through stressors. Future research should systematically look

into control perceptions, self-efficacy, and affect as other potential mediators.

The present study adds to the existing literature in the following ways. First, it contributes to our knowledge on the actual implementation of innovation. This is important because only implemented innovations can benefit the work place, and so far, there is a dearth research focusing on the stressor – innovation implementation linkage.

Second, we argued that research on discretionary work innovation behaviours that used combined measures of ideation and implementation may mask differential relationships between stressors and ideation and implementation, respectively. Findings of this study do not support this. The positive effect of work demands with implementation is similar to the positive effect of time pressure (Wu et al., 2014) and job demands (Janssen, 2000) reported for combined measures of innovation. However, even if there is no evidence for differential stressor – innovation / implementation relationships, the present paper adds to existing knowledge by extending the breadth of stressors considered. Zhou (2003) highlighted the effect of close monitoring on discretionary innovative work behaviours; but with few exceptions (see Leung et al., 2011) little is known about the effect of role ambiguity, role conflict and professional compromise, in particular about the simultaneous effect of different types of stressors.

Third, much of the current research on stress-outcomes is conducted through the lens of the challenge-hindrance framework. Looking at the results through this lens suggests that innovation implementation – a voluntary, discretionary work behaviour – follows the same pattern as core task performance (LePine et al., 2005). At the same time, there are differences, because strain does not act as a mediator (LePine et al., 2005). This suggests that future research on stress outcomes needs to continue to acknowledge different types of work performances. This point is also underpinned by findings on other discretionary work behaviours. More specifically, a meta-analysis revealed that – similar to the present research – the direct relationships of role ambiguity and conflict with organizational citizenship

behaviours (OCB) are negative; but unlike the present research, overload (which is comparable to job demands) was also negatively related to OCB (see Table 1 in Eatough, Chang, Miloslavic, & Johnson, 2011). This suggests that we need different theories (e.g., cybernetic stress theory, transactional theory, social exchange theory) to explain different patterns of stressors – performance relationships for different types of work performances.

Strengths, Limitations, and Directions for Future Research

The present study has strengths and weaknesses. We complemented the secondary analysis (Study 1, UK) with a replication study. This revealed a pattern of stressor – innovation implementation relationship which was consistent across the two independent samples. The samples differ in jobs, countries, and time lags. This speaks for the robustness of effects. A further strength relates to the time lagged instead of cross-sectional approach. This reduces the risk of common method variance due to measuring all constructs at the same point in time. However, despite this, we need to be cautious to draw causal conclusions.

The time lag of two years in Study 1 is long and, as we could not control for the level of innovation implementation at Time 1, our conclusion that stressors affected the outcomes can legitimately be questioned. In the light of previous research, however, we still assume that results may be valid. The finding of the present study that characteristics of the workplace seem to influence or shape employee outcomes in the long run is not unprecedented. For example, a multi-wave longitudinal study showed that stressors predicted changes in subsequent discretionary non-innovative work behaviours in the course of one and two years (Fay & Sonnentag, 2002). Other researches conducting longitudinal and cross-lagged panel analyses showed that various characteristics of the workplace affect changes in discretionary work behaviours within four months (Caesens, Marique, Hanin, & Stinglhamber, 2016) or twelve months (Griffin, Parker, & Mason, 2010). Similarly, there is research from an occupational health perspective that documents the long-term effects of stressors on employee outcomes (e.g. strain; see 4-month cross-lagged analysis conducted by Oliver, Mansell, &

Jose, 2010). Thus, previous longitudinal research suggests that long-term effects of stressors and other characteristics of the work environment on employee behaviours and other outcomes are not implausible.

However, a time lag of two years raises the question about the temporal dynamics that may underlie the findings. We propose that stressors unfold their effects on attitudes and behaviors two years later because of their high stability (see the one-, two-, and five year latent stability reported in (Garst, Frese, & Molenaar, 2000), Table 14). We do not propose that stressors at Time 1 act like a singular or one-time event, to which two years later a reaction happens. Instead, the level of stressors individuals were exposed to at Time 1 is likely to have remained at fairly the same level over time. This means that the signal of a "need to change" for high stressor individuals continues to act and thus may continuously trigger innovation implementation.

Even though other research may lend some plausibility to our findings, it does not resolve the fact that the lagged analysis of Study 1 is not conclusive in terms of causality. We sought to address this by including a longitudinal analysis in Study 2. However, when including the Time 1 level of innovation implementation into the analyses, the effects of the stressors turned insignificant. Strictly speaking, this implies that there is no such effect. However, this type of longitudinal approach is only conclusive if an appropriate time frame has been chosen and if there is sufficient change in the variables. It may well be that the time frame of two weeks was too small for sufficient change variance to develop. Thus, causality still warrants testing, and future research should employ longitudinal designs. The challenge resides in the choice of an appropriate time lag; there is so far little theory development which allows theory-based a priori decisions on the appropriateness of time lags.

A weakness relates to the nature of our measures, as both stressors and innovation implementation are based on self-reports. Relying on self-report measures for performance-related outcomes is frequently criticised. However, the innovation implementation measure

used here has demonstrated to have satisfactory convergence with other-ratings. Axtell and colleagues (2000) report an agreement of r = .42 for self- and supervisor-rating; similar results were obtained in an earlier study (r = .54) (West, 1987). A modified version applied in the context of health service teams also showed substantial agreement between team members' self-reports of team innovation and ratings provided by independent raters (r = .73) (West & Anderson, 1996), supporting the scale's external validity. Based on these and other findings, a meta-analysis in this field concluded that self-ratings are not "inherently invalid" (p. 1041, Ng & Feldman, 2012). For work place stressors, the agreement between self- and other reports are even higher (r between .65 and .70) (Grebner, Semmer, & Elfering, 2005). However, ideally self-report measures should be complemented with objective measures.

A further weakness and thus promising avenue for future research relates to the actual nature of innovation implementation. We propose innovation implementation to be a form of problem-focused coping, but we do not know whether the innovations implemented actually try to change the stressor, or a different aspect of the job.

Finally, we cannot draw any conclusions yet whether innovation implementation is an effective way of coping with stressors, benefitting the well-being of job holders. The longitudinal designs proposed above would also allow for testing reciprocal effects of innovation, stressors and indicators of well-being. Implementing innovations, in particular when it is performed as a discretionary activity, is likely to involve costs for the actor. Studies have shown that individuals who engage in innovative behaviours may experience more conflicts with colleagues (Janssen, 2003). Other research suggests that days with high levels of discretionary behaviours result in higher levels of fatigue on that day and elevated levels physiological stress indicators (Fay & Hüttges, 2016); links of discretionary behaviours to strain have also been reported (Strauss, Parker, & O'Shea, 2017). Thus, in order to obtain a comprehensive picture of the stressor – innovation implementation linkages, reciprocal effects and further consequences of innovation implementation need to be taken into account.

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Table 1

Descriptive Statistics and Intercorrelations

	Study 1		Study 2													
	M	SD	M	SD	1	2	3	4	5	6	7	8	9	10	11	12
1.Work demands T1	3.20	1.03	2.40	0.85	.92/.90	.30**	.53**	.53**	.06	-.18**			-.02	.04		
2.Role ambiguity T1	2.10	0.70	1.88	0.60	.40**	.80/.87	.35**	.35**	-.17**	-.21**			-.15*	.08		
3.Role conflict T1	2.50	0.99	2.53	0.84	.65**	.36**	.87/.85	.50**	-.10	-.22**			-.05	-.03		
4.Prof. compr. T1	3.20	0.92	2.41	0.84	.76**	.34**	.66**	.79/.79	-.09	-.30**			-.11	.04		
5.Innov. impl. T2	2.50	1.06	2.64	0.88	.05	-.09	.01	-.09	.92/.93	.20**			.03	.05		
6.Org. comm. T2	3.11	0.80								.76/-			.13*	-.09		
7.Strain T1			3.10	1.09	.46**	.22*	.34**	.45**	-.16		-/.87					
8.Strain T2			3.20	1.15	.44**	.21*	.35**	.48**	-.20*		.77**	-/.90				
9.Age	38.00	9.70	43.20	9.93	.05	-.19*	-.07	.02	-.05		-.07	-.09	-	-.03		
10.Gender [a]	0.10	0.30	0.48	0.50	-.01	-.05	.02	-.13	-.06		.03	.01	.19*	-		
11.Job tenure			14.8	1.77	.14	-.20*	.01	.08	-.10		-.08	-.08	.57**	.18*	-	
12.Working hours[b]			1.15	0.36	.06	-.08	.02	.13	-.07		.03	.02	.05	-.28**	.06	-
13.Job qualification [c]			1.22	0.41	-.10	-.03	.09	-.01	-.18*		-.09	.02	.25**	.06	-.15	-.13

Note. Study 1: N = 230-235, Study 2: N = 138. Cronbach's alphas are presented on the diagonal. Correlation coefficients for Study 1 are reported above, Study 2 below the diagonal.
[a] Gender: 0 = female, 1 = male. [b] Working hours: 1 = 35h or more / week, 2 = between 20h and 35h / week; Sample 1: all full time. [c] Job qualification: 1 = apprenticeship / university degree, 2 = further training / retraining; Study 1: qualified nurses. T1 = Time 1, T2 = Time 2.
† p < .10, * p < .05, ** p < .01

Table 2

Multilevel Structural Equation Modelling Mediation Analysis of Effects of Work Demands, Role Ambiguity, Professional Compromise, and Organizational Commitment on Innovation Implementation

	Direct effects analysis			Analysis with indirect effects			
	β	SE	95% CI	β	SE	95% CI	90% CI
Age T1	.002	.06	[-.11, .11]	-.02	.07	[-.11, .11]	[-.12, .09]
Gender T1 (0 = female, 1 = male)	.05	.07	[-.08, .19]	.07	.06	[-.06, .20]	[-.03, .18]
Work demands T1 (a)	.29**	.07	[.15, .44]	.27**	.09	[.12, .50]	[.15, .47]
Role ambiguity T1 (b)	-.18*	.08	[-.05, -.32]	-.15†	.08	[.01, -.55]	[-.03, -.50]
Role conflict T1 (c)	-.03	.11	[-.22, .15]	-.01	.11	[-.30, .26]	[-.03, -.50]
Professional compromise T1 (d)	-.23*	.08	[-.37, -.09]	-.17*	.10	[-.34, -.01]	[.20, -.17]
Organizational commitment T2 (m)				.20**	.08	[.11, .47]	[.14, .45]
Indirect effect (a*m)				.02	.02	[-.02, .05]	[-.01, .05]
Indirect effect (b*m)				-.06†	.03	[.01, -.12]	[-.001, -.11]
Indirect effect (c*m)				-.02	.03	[-.08, .03]	[-.07, .02]
Indirect effect (d*m)				-.07*	.03	[-.14, -.01]	[-.13, -.02]
R^2	9.0%			12.4 %			

Note. Standardized regression coefficients are reported; T1 – Time 1, T2 – Time 2; †p < .10 *p < .05; **p < .01.

Table 3

Multiple Hierarchical Regression Analysis of Innovation Implementation on Stressors

	Predictors	R^2	F	p	ΔR^2	ΔF	Δp	β
Step 1	Control variables	.08	2.16	.06				
	Age							.16
	Gender [a]							-.07
	Tenure							-.21†
	Working hours[b]							-.12
	Job qualification[c]							-.27**
Step 2	Stressors	.14	2.39	.02	.07	2.54	.04	
	Role ambiguity T1							-.19*
	Role conflict T1							.15
	Profes. compr. T1							-.32*
	Work demands T1							.27*[d]
Step 2a	Mediator: Strain	.12	2.46	.02	.04	3.04	.05	
	Irritation T1							-.07
	Irritation T2							-.15
Step 3a	Stressors	.20	2.78	.01	.08	3.06	.02	
	Role ambiguity T1							-.19*
	Role conflict T1							.15
	Profes. compr. T1							-.23†
	Work demands T1							.35**
Step 2b	Longitudinal	.36	12.11	.01	.28	57.24	.01	
	Innovation impl. T1							.54**
Step 3b	Stressors	.38	7.90	.01	.03	1.36	.25	
	Role ambiguity T1							-.13
	Role conflict T1							.12
	Profes. compr. T1							-.18
	Work demands T1							.07

Note. N = 138. Standardized regression coefficients are reported; [a] Gender: 0 = female, 1 = male. [b] Working Hours: 1 = 35h or more / week, 2 = between 20h and 35h / week. [c] Job qualification: 1 = apprenticeship / university degree, 2 = further training / retraining. $^{\dagger}p < .10$ $^{*}p < .05$; $^{**}p < .01$. [d] exact p = .0504.

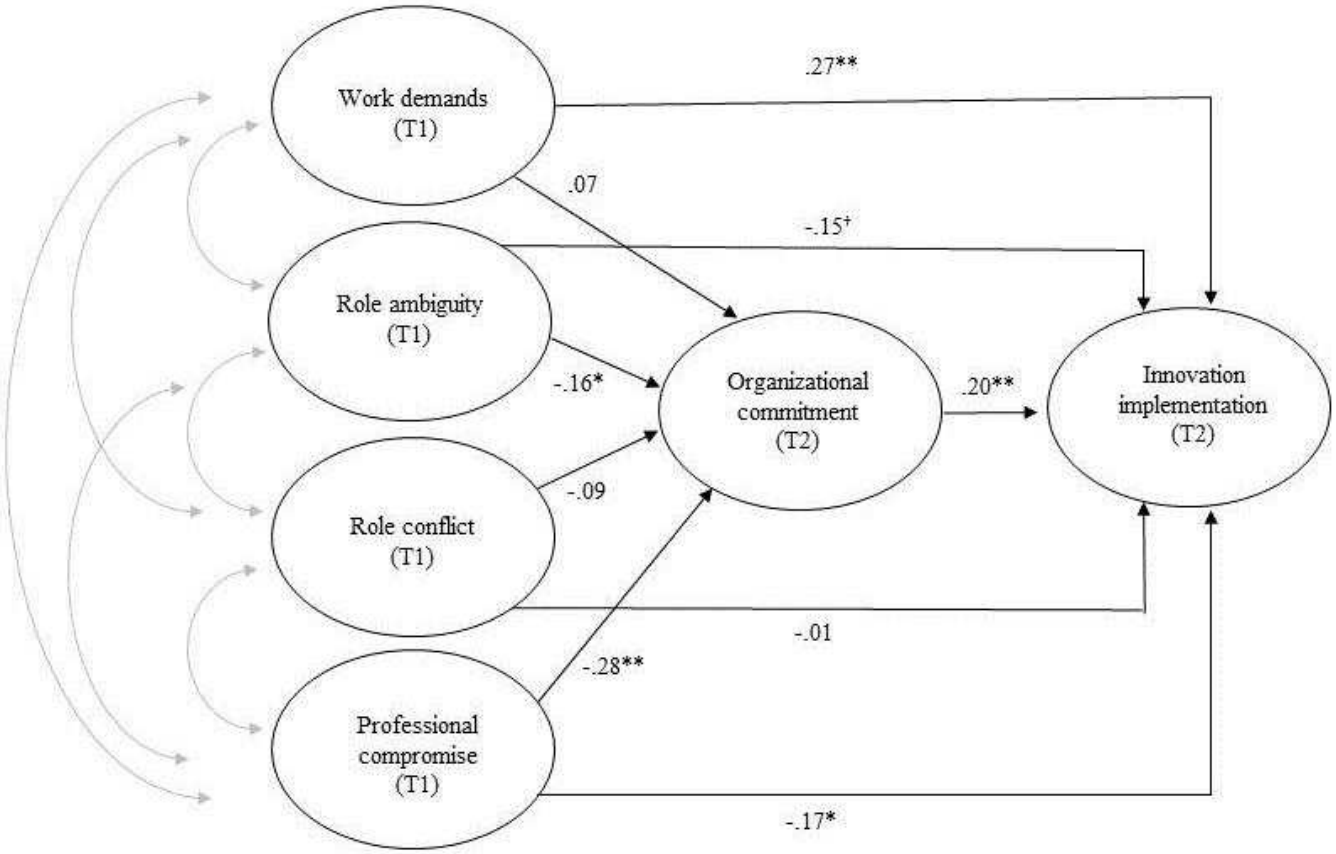

Figure 1. Results of structural equation modelling.

The path coefficients are standardized; N = 235; T1 – Time 1, T2 – Time 2; *p < .05; **p < .01.