Work stress and negative affectivity: a multi-method study

A. Falco¹, D. Girardi¹, G. Marcuzzo², A. De Carlo³ and G. B. Bartolucci⁴

¹Department FISPPA, Section of Applied Psychology, University of Padua, Padua 35131, Italy, ²Occupational Medicine Unit, University Hospital of Padua, Padua 35128, Italy, ³LUMSA, University of Rome, Rome 00193, Italy, ⁴Department of Molecular Medicine-Occupational Medicine Unit, University of Padua, Padua 35128, Italy.

Correspondence to: A. Falco, Via Venezia 8, Padua 35131, Italy. Tel. +39 049 8276588; fax +39 049 8276590; e-mail: alessandra.falco@unipd.it

**Background**
In the literature negative affectivity (NA) is considered both a confounding variable as well as a predictive variable for work-related stress. However, a common limitation in this line of research relates to the use of self-report measures for determining NA, perceived stressors and psychophysical strain.

**Aims**
To test, using a multi-method study, a theoretical model that correlates NA, perceived interpersonal conflict (with co-workers and supervisors), psychophysical strain and medically certified sickness absences.

**Methods**
A multi-method prospective study was carried out on a sample of metalworkers. NA and interpersonal conflict were determined using self-report (Time 1), whereas psychophysical strain was determined by an occupational physician (Time 2). Data on medically certified sickness absences were collected from the company’s database (Time 3).

**Results**
There were 326 participants. The results showed an association between NA and conflict with co-workers, as well as between NA and conflict with supervisors. Psychophysical strain could be predicted from NA and conflict with co-workers but not from conflict with supervisors. NA had a significant indirect effect on psychophysical strain through conflict with co-workers. Lastly, psychophysical strain predicted sickness absences from work.

**Conclusions**
NA influenced psychophysical strain in the worker, both directly and indirectly, through perceived conflict with co-workers.

**Key words**
Conflict with co-workers; conflict with supervisor; multi-method study; negative affectivity; psychophysical strain; sickness absences.

**Introduction**

Work-related stress is a complex phenomenon, which affects both the health of the worker and organizational productivity [1,2]. For this reason, considerable attention has been paid to identification of work environment characteristics (i.e. stressors) that may trigger a psychological, physical or behavioural response in the individual (i.e. psychophysical strain) [2,3]. Some studies have highlighted an association between interpersonal conflict (i.e. stressors) and strain [4,5]. In addition, some individual characteristics may influence the relationship between stressors and strain [2]. Among these negative affectivity (NA) is particularly relevant. Watson and Clark [6] defined NA as a personality trait that reflects pervasive differences in the conception of the self and the tendency to experience negative emotional states. High-NA individuals tend to experience negative feelings such as guilt, fear, anxiety, and nervousness. They also tend to have a negative idea of themselves and concentrate on the negative aspects of other people and of the world in general [7]. Some authors consider NA as a variable that can substantively influence the relationship between stressors and strain. For example, the neurotic behaviour of high-NA individuals may lead to negative reactions from supervisors and co-workers [8]. Moreover, since high-NA individuals tend to focus on the negative side of others and the world in general, they may perceive high levels of interpersonal conflict [6], which in turn produces higher levels of strain. NA thus exerts an indirect effect on strain...
through interpersonal conflict (i.e. interpersonal conflict mediates the relationship between NA and strain). Other authors consider NA as a confounding variable in the stressors-strain process [9]. According to this perspective, NA accounts for the relationship between stressors and strain. High-NA individuals perceive relationships with colleagues/supervisors more negatively and at the same time they report higher levels of strain [10]. Additionally, NA may also act as a source of common method bias (CMB) [11,12]. High-NA individuals tend to respond in a negative way to self-report measure of both stressors and strain, thus artificially inflating correlation between constructs. CMB poses a rival explanation for the observed relationship between self-reported stressors and strain [12].

However, a limitation common to most studies on this theme consists in the use of self-report measures to determine both interpersonal conflict and strain at the same time [4,9]. With a research design of this kind it is impossible to establish whether the relationship observed between stressors and strain reflects the actual relationship between constructs or whether this relationship is artificially inflated by NA. In order to overcome these limitations we designed a multi-method prospective study to investigate the relationship between NA, interpersonal conflict, psychophysical strain, and sickness absence (SA). In particular, interpersonal conflict was considered as a stressor because there are few studies that consider the relationship between NA, interpersonal conflict and strain in the literature [4]. To the authors’ knowledge, none of these studies differentiate between conflict with supervisors (CWS) and conflict with co-workers (CWC), which can, however, have different effects in terms of strain [13]. Additionally, SA is a health-related behaviour that reflects the health of employees [7,14]. However, since SA may depend on other factors besides the employee’s health (e.g. psychosocial issues), medically certified SA has been analysed. Indeed some studies have shown a link between medically certified SA and future disability pension and mortality [14,15].

In accordance with the literature we tested a model in which conflict both with supervisors and with co-workers is related to psychophysical strain that, in turn, predicts SA [4,16]. In our model we also estimated direct effects of NA on both interpersonal conflict (NA→CWS and NA→CWC) and psychophysical strain (NA→strain). These direct effects are indeed predicted by both mediation (i.e. NA exerts both a direct and an indirect effect on strain through interpersonal conflict) and confounding (i.e. NA is related to both CWS/CWC and strain) frameworks [17]. However a critical difference between the two frameworks concerns the relationship between interpersonal conflict and strain. If NA acts as a confounding variable one would expect the actual relationship between interpersonal conflict and strain to be null, once the NA effect has been controlled for (i.e. NA accounts for the relationship between stressors and strain) [18]. On the other hand if NA substantively influences the relationship between stressors and strain we would expect NA to influence interpersonal conflict that, in turn, actually predicts strain (i.e. interpersonal conflict mediates the relationship between NA and strain) [8]. Taking this type of approach, one would expect that relationships between interpersonal conflict and strain would not be subject to measurement bias (i.e. differential misclassification) linked to the use of the same measurement method to determine both the independent and dependent variables [12]. Indeed it is thought that NA does not affect the physician’s rating [7]. An observed relationship between interpersonal conflict and strain would then reflect the actual relationship between stressors and strain, controlling for NA.

Methods

This study was carried out in a private company in the metal engineering sector. Workers were informed beforehand by management and participated voluntarily in the investigation of work stress structured in three phases over a period of two years. The first phase (Time 1) took place in February 2010. Employees completed a self-report questionnaire designed to determine NA and interpersonal conflict. Each worker was given an identification code in order to connect their self-report measures to subsequent findings (psychophysical strain, and SA). This procedure took place after obtaining the written consent of each worker. Confidentiality was assured by the occupational physician and the occupational psychologist, who were both bound by professional duties of confidentiality. NA was determined using the Italian version of the Strain-Free Negative Affectivity Scale (9 items, Cronbach’s $\alpha = 0.76$) [19]. The scales of CWS (8 items, Cronbach’s $\alpha = 0.92$) and conflict with co-workers (7 items, Cronbach’s $\alpha = 0.88$) were taken from the Q$_2$-BO, an instrument standardized for the Italian context [20].

In December 2010 (Time 2) workers were assessed by the occupational physician who determined psychophysical strain using the Psychophysical Health Inventory (PPHI). The chart has five distinct dimensions of psychophysical strain, namely: anxiety symptoms, depression symptoms, gastrointestinal disorders, heart disease and disorders linked to poor ergonomics in the workplace. Items were rated on a Likert-type scale, from 1 = never to 6 = every day. The choice of this time interval between Time 1 and Time 2 is in line with previous studies that have considered the relationship between NA, stressors, and strain [10,11]. The PPHI was administered by the physician at the end of an annual medical check-up. The worker was informed that the purpose of the investigation was to detect possible disorders linked to work stress. The use of PPHI allows association of
symptoms (which are known to be stress-related on an epidemiological basis) with work situations, based on criteria of temporal sequences and exclusion of all symptoms due to other causes (such as previous pathologies or identified non-work situations). Administration took 20–30 min, depending on what emerged in the course of the assessment [21].

The third phase of the study (Time 3) involved the determination of medically certified SA in 2011. Data on absences, in terms of the number of days of time lost [16], were collected directly from the company’s database between January 2011 and December 2011. Since absenteeism is a low base-rate behaviour (i.e. most employees exhibit relatively low absence levels while a few exhibit higher levels), the number of SA days was added together over a one year period [16,22].

Data analysis was carried out using structural equation modelling with latent variables with LISREL 8.8 software [23]. The main advantage of this technique lies in being able to estimate direct and indirect effects between constructs while controlling for measurement errors [24]. Before analysing the data, missing data were taken into consideration. None of the participants had extensive missing data (i.e. >25% of the variables considered in the study) [25]. Missing values were therefore estimated using the algorithm Expected Maximization [26].

The first step in data analysis was to test the metric properties of PPHI, which is used here for the first time. For this purpose, we conducted a confirmatory factor analysis (CFA). The theoretical model envisages five dimensions of psychophysical strain explained by a second order factor, i.e. psychophysical strain. The hypothetical theoretical model was then tested. Parcels of scale items were created for NA, interpersonal conflict, and strain [27]. SA was measured using a single indicator, the number of days of medically certified SA during 2011. We assessed model fit using the χ² test, the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the non-normed fit index (NNFI), and the standardized root mean square residual (SRMR). Since the χ² is affected by sample size, the use of additional fit indices is recommended [24]. For RMSEA and SRMR, values close to or smaller than 0.08 indicate a good model fit. For CFI and NNFI values close to or greater than 0.95 indicate a good model fit [28]. The significance of the indirect effect (i.e. mediation) was tested using the Sobel test [29]. In LISREL notation, lowercase Greek letters represent parameters estimated in the model. λ represents standardized factor saturation, γ denotes standardized regression coefficient between independent and dependent variables, whereas β symbolizes standardized regression coefficient between two dependent variables [24]. Altogether five models were tested in this paper. Model 1 and Model 1a refer to the factor structure of the PPHI. Model 2 is the theoretical model proposed.

In order to check whether NA predicts SA, an alternative model (Model 3) was tested, in which effect of NA on SA is freely estimated. Fit of the two models (Model 2 and Model 3) was compared using the chi-square difference test [24].

Finally, Model 4 tests the reverse causation hypothesis, according to which interpersonal conflict causes NA, which in turn produces strain (i.e. causality mechanism) [7,8]. Model 2 and Model 4 were then compared using the Akaike Information Criterion (AIC) for non-hierarchical model. Lower values for AIC indicate a better fit [24].

Fit indices relative to all models tested are reported in Table 1.

### Results

There were 326 participants in the study. Two hundred and forty (74%) participants had no missing data, and 312 (96%) participants had up to four missing data items. Descriptive data are presented in Table 2. In order to test PPHI factor structure a CFA was carried out (Model 1). Indices show good fit to the data: χ²(225, n = 326) = 446.4, P < 0.001; RMSEA = 0.056; NNFI = 0.958; CFI = 0.963; SRMR = 0.060. Nevertheless item MEDdep4 (faints) shows low standardized factor saturation (λ = 0.09). For this reason a second CFA was carried out eliminating item MEDdep4 (Model 1a). Indices show good fit to the data: χ²(204, n = 326) = 399.0, P < 0.001; RMSEA = 0.056; NNFI = 0.963; CFI = 0.967; SRMR = 0.058. Standardized factor saturations are all >0.40 (Figure 1). Correlations between latent first order factors vary in intensity from 0.49 to 0.77. Overall, PPHI shows satisfactory convergent and discriminant validity. The theoretical model (Model 2) was then tested (Figure 2). Fit indices show good fit to the data:

### Table 1. Model-tested fit indices

<table>
<thead>
<tr>
<th></th>
<th>χ²</th>
<th>df</th>
<th>RMSEA</th>
<th>NNFI</th>
<th>CFI</th>
<th>SRMR</th>
<th>AIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1a</td>
<td>399.0</td>
<td>204</td>
<td>0.056</td>
<td>0.963</td>
<td>0.967</td>
<td>0.058</td>
<td>505.9</td>
</tr>
<tr>
<td>Model 2</td>
<td>183.0</td>
<td>84</td>
<td>0.060</td>
<td>0.964</td>
<td>0.971</td>
<td>0.051</td>
<td>253.7</td>
</tr>
<tr>
<td>Model 3</td>
<td>182.2</td>
<td>83</td>
<td>0.060</td>
<td>0.963</td>
<td>0.971</td>
<td>0.051</td>
<td>254.7</td>
</tr>
<tr>
<td>Model 4</td>
<td>198.3</td>
<td>86</td>
<td>0.064</td>
<td>0.960</td>
<td>0.967</td>
<td>0.071</td>
<td>269.7</td>
</tr>
</tbody>
</table>
The Sobel test indicated that total indirect effect of NA on strain through interpersonal conflict was significant ($z = 3.07, P < 0.01$). However, the indirect effect of NA on strain through CWC was significant ($z = 2.80, P < 0.01$), whereas indirect effect of NA on strain through CWS was not significant ($z = -0.02, NS$). Moreover, we checked whether NA predicts SA. The alternative model (Model 3), less parsimonious, does not show a better fit than that for the proposed theoretical model (Model 2), more parsimonious ($\chi^2(1, n = 326) = 0.817, NS$). The alternative model is therefore rejected. NA does not predict SA ($\gamma = -0.07, NS$).

Finally, we compared Model 2 and Model 4 using the AIC. Model 4 (causality mechanism) shows higher AIC than that for the proposed model (Model 2): $AIC_{Model4} = 269.7; AIC_{Model2} = 253.7$. Model 2 is therefore preferred.

Discussion

In this study, we found NA to be positively associated with both dimensions of interpersonal conflict, and it also predicted psychophysical strain over time. In addition, conflict with co-workers (CWC) predicted strain over time after controlling for prior level of NA, whereas CWS did not. Moreover, strain predicted medically certified SA over time. Lastly, NA exerted a total indirect effect on strain through interpersonal conflict. However, CWC mediated the relationship between NA and strain, whereas CWS did not.

The results suggest that NA did not act as a confounding variable in the stressors-strain process. But a relationship did emerge between interpersonal conflict and psychophysical strain after controlling for the NA effect. This relationship is not artificially inflated by NA, since interpersonal conflict and strain have both been evidenced using two measurement methods on two different occasions. Mediation analysis however, suggests that NA can substantively influence the relationship between stressors and strain. NA is positively related to interpersonal conflict as a whole that, in turn, actually predicts psychophysical strain [4]. Moreover NA predicts psychophysical strain over time.

Our model shows that only CWC mediated the relationship between NA and strain. This is an interesting result in that, to the authors’ knowledge, this is the first study to integrate NA, the two dimensions of interpersonal conflict and psychophysical strain within the same theoretical framework. This result is in accordance with Frone’s [5] hypothesis that CWS is associated with negative outcomes in the workplace (e.g. high turnover), whereas CWC is associated with negative outcomes at a personal level (e.g. depression and somatic symptoms).

Lastly, this research found that psychophysical strain predicted subsequent medically certified SA. Work-related stress thus has repercussions on the worker’s health [16].

A strength of this paper is the use of different methods to measure interpersonal conflict and strain, so as to eliminate the bias effect of NA on the relationship between stressors and strain. In this study, interpersonal conflict was identified through self-report at Time 1, whereas psychophysical strain was ascertained by the occupational physician during health checks at Time 2. Moreover use of a prospective design allowed information to be obtained on the causal pathway between interpersonal conflict and strain [12,30]. According to the reversed causation hypothesis, individuals with poor health drift to worse jobs because of their personal record of frequent absences from work (i.e. drift-hypothesis) [30]. One of the drawbacks of the present study is that both NA and interpersonal conflict are determined at the same time. It cannot therefore be excluded that prolonged exposure to high levels of stressors tends to increase NA in individuals and consequently indirectly creates psychophysical stress (i.e. causality mechanism) [8]. However we maintain that our model is preferable at both a theoretical and an empirical level.

### Table 2. Characteristics of the study population and descriptive data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Score, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;40 years</td>
<td>126 (39)</td>
</tr>
<tr>
<td>Between 40 and 50 years</td>
<td>150 (46)</td>
</tr>
<tr>
<td>&gt;50 years</td>
<td>50 (15)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>236 (72)</td>
</tr>
<tr>
<td>Female</td>
<td>90 (28)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td>Primary schools</td>
<td>100 (31)</td>
</tr>
<tr>
<td>Degree/specialization</td>
<td>176 (54)</td>
</tr>
<tr>
<td>University degree, Post-graduate degree</td>
<td>50 (15)</td>
</tr>
<tr>
<td><strong>Position</strong></td>
<td></td>
</tr>
<tr>
<td>Workman</td>
<td>175 (54)</td>
</tr>
<tr>
<td>Clerk</td>
<td>120 (37)</td>
</tr>
<tr>
<td>Manager</td>
<td>31 (9)</td>
</tr>
<tr>
<td><strong>Negative affectivity</strong></td>
<td>Mean 3.58 (SD 0.70)</td>
</tr>
<tr>
<td>CWSs</td>
<td>Mean 2.10 (SD 1.06)</td>
</tr>
<tr>
<td>CWC</td>
<td>Mean 2.61 (SD 1.05)</td>
</tr>
</tbody>
</table>

$\chi^2(84, n = 326) = 183.0, P < 0.001$; RMSEA = 0.060; NNFI = 0.964; CFI = 0.971; SRMR = 0.051. A positive association can be observed between NA at Time 1 and CWS at Time 1 ($\gamma = 0.14, P < 0.05$), CWC at Time 1 ($\gamma = 0.28, P < 0.001$) and psychophysical strain at Time 2 ($\gamma = 0.44, P < 0.001$). Additionally, CWC determined at Time 1 predicts psychophysical strain at Time 2, after controlling for NA at Time 1 ($\beta = 0.24, P < 0.001$), whereas CWS at Time 1 does not predict psychophysical strain at Time 2 ($\beta = 0.00, NS$). Lastly, psychophysical strain determined at Time 2 predicts SA determined at Time 3 ($\beta = 0.14, P < 0.05$).
From a theoretical point of view NA is posited as a stable personality trait that is not affected by environmental variables (e.g. stressors). Some longitudinal studies have reported substantial stability of NA over time [10,11]. Additionally, Oliver et al. [11] found in a longitudinal study that NA predicts work stressors over time, but work stressors do not predict NA over time.

From an empirical point of view both NA and interpersonal conflict would need to be measured on two different occasions in order to address the problem of reverse causation [30]. Although it was not possible to achieve a research design of this kind we found that the proposed model showed a better fit to data than the reverse causation model. On the whole our study suggests that NA predicts interpersonal conflict and not vice versa, but only a further study can clear up this point. A further limitation consists in having tested the model on a single sample. Although this may be justified by the time-consuming research method adopted, in particular with regard to the occupational physician, it poses problems for the generalization of the results.

This study has several practical implications. Determination of work stress and organizational well-being within a specific organization should favour a

Figure 1. Standardized solution of the PPHI. All paths are significant at $P < 0.001$. GAST = gastrointestinal disorders; ERG = disorders linked to poor ergonomics in the workplace; CARD = heart disease; ANX = anxiety symptoms; DEP = depression symptoms; STRAIN = psychophysical strain.
multi-method approach, with employees’ self-evaluations integrated with hetero-evaluations on the part of supervisors and co-workers (e.g. work features) and/or objective indicators of negative outcomes (e.g. SA, turnover). Given the possible consequences both for the individual (e.g. strain, SA) and for the organization (e.g. high levels of conflict, low productivity) occupational physicians should consider adopting (either alone or with the collaboration of psychologists or psychotherapists) processes to identify high-NA individuals and minimize the negative consequences of NA.

During occupational health surveillance processes occupational physicians are in a position to identify NA levels in subjects with high levels of interpersonal conflict, or in those identified by colleagues or managers as displaying features suggestive of NA. Subsequently cognitive-behavioural intervention strategies (e.g. cognitive restructuring) can be offered to make perception of the work environment more rational and limit the influence of NA in generating a distorted perception of it.

### Key points

- This study was designed to test a theoretical model that correlates negative affectivity, perceived interpersonal conflict, psychophysical strain and medically certified sickness absence using a multi-method prospective approach.
- Negative affectivity and interpersonal conflict were assessed using self-reporting, whereas psychophysical strain was assessed by the occupational physician. Data on absences were collected directly from the employer’s database.
- In this study negative affectivity influenced psychophysical strain in the worker both directly and indirectly through perceived conflict with co-workers.

### Conflicts of interest

None declared.

### References


