

Risk assessment of occupational stress: Extensions of the Clarke and Cooper approach

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Abstract

For an organization to prevent occupational stress problems, it is necessary to correctly diagnose the characteristics of the work and employment conditions that are perceived as risks by employees and to investigate the consequences of these risks. Clarke and Cooper propose a methodology to assess which organizational factors pose the highest levels of risk to the well-being of employees. A level of risk is calculated based on the exposure level of a hazard and on the level of negative consequences associated with this exposure. The methodology has proven to be useful to prioritize and target specific areas for interventions. The present study introduced significant developments to this methodology by incorporating a coping dimension into the formula in order to better reflect the theoretical stress model. Tested on a sample of employees from a hospital centre ($N = 1229$), the introduction of coping strategies in the computation of risk level increases the strength of the relationship between risk exposure and outcomes, illustrating that the improved formula constitutes a more precise method to assess risk.

Keywords: *Risk assessment, risk management, occupational stress, methodology, coping*

Introduction

As many concerns are raised by the rapid organizational changes in today's workplace, there is a need for improved monitoring of work organization factors in order to better prevent potential risks posed by these changes (Murphy and Sauter 2004). Faced with the increasing individual and organizational costs of occupational stress, many organizations are trying to prevent the problem either by actions aimed at helping the individual (secondary and tertiary interventions) or by intervening to modify various aspects of the organizational stressors to prevent the risks at source (primary interventions). Working in a stressful environment increases the risk not only of suffering physical illness or symptoms of psychological distress, but also work-related accidents and injuries (Clarke and Cooper 2004). Despite the abundance of empirical evidence supporting work stress models (e.g. Cooper and Marshall 1976, Karasek and Theorell 1990, Cox 1993, Siegrist 1996) and the adverse health effects of stressors, intervention strategies currently used by employers are predominantly focused on the individual (Kompier and Cooper 1999, Giga *et al.* 2003, Murphy and Sauter 2003, 2004).

As Clarke and Cooper (2000, 2004) argue, what is often lacking is a systematic and detailed procedure to assess, analyse, and manage workplace stress. Consequently, they propose a risk management methodology that allows employers to assess risks in the workplace and their adverse effects on employees' health, thus helping them to determine which risks should be given priority for developing risk control measures. Within this methodology, risk is defined as 'a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence' (Warner 1992: 4). In order to estimate more precisely the level of risk of occupational stress, the present article aims to enhance this risk management methodology by adding the coping strategies used by individuals to manage workplace stress. While keeping the focus on organizational risk factors, the inclusion of coping strategies in the risk calculation can further ground the risk assessment results in organizational stress theories (Cooper 1998) and workers' reality.

Importance of a systematic approach to the risk management of workplace stress

The risk assessment is often the first step taken by organizations in order to intervene on work-related stress. Also, to be able to assess the benefits related to any ulterior intervention, baseline data is necessary. Although this statement may seem obvious, stress prevention is often not approached in this way. Indeed, organizations usually overemphasize interventions on individual factors and manage the consequences of work stressors, instead of changing the work environment and preventing stress at its source (Kompier et al. 1998, Cox et al. 2000, Giga et al. 2003, Murphy and Sauter 2003, Vézina et al. 2004). Many authors point out that one of the key factors of a successful approach to preventing occupational stress is an adequate diagnosis or risk analysis (Kompier et al. 1998, Cox et al. 2000, National Institute for Occupational Safety and Health 2002, Clarke and Cooper 2004). By determining to which work characteristics employees are the most exposed, and which are most associated with health, managers and employers can make more informed decisions in order to reduce stressful work conditions and their consequences.

Risk definition and risk assessment

There is no universally accepted definition of risk. Many authors suggest that the term refers to a combination of the probability or frequency of occurrence of a hazard (something with the potential to cause harm) and the impact of this hazard (Rowe 1990, Singleton and Jovden 1992, Warner 1992, Clarke and Cooper 2000, Bedford and Cooke 2001, Health & Safety Executive 2001). The product of the probability or frequency at which a group of employees is exposed to a hazard and the severity of the consequences of this exposure constitute an estimate of the risk level. Exposure to work stressors can be conceptualized as chronic and resulting from an accumulation of hazardous situations rather than as an acute exposure to one isolated event (for example, a hold-up or a physical aggression) (Cox 1993, Clarke and Cooper 2000, 2004). The adverse effects of a prolonged exposure to occupational stressors can be compared to a 'slow accident' (Clarke and Cooper 2000).

Original calculation of risk factor and its limits

In their article, Clarke and Cooper describe explicitly the procedure to calculate a risk factor (Clarke and Cooper 2000: 179–180):

$$\text{Risk factor} = \text{exposure (E)} \times \text{consequences (C)}$$

where E is the perceived level of stressor (exposure) and C is the correlation (R^2) between stressor level and stress outcome (consequences). For measuring the impact of risk factors on a variety of stress outcomes, a regression of stress exposure for each risk factor on stress outcomes is computed and the variance explained in the risk factor (R^2) constitutes the perceived level of consequences.

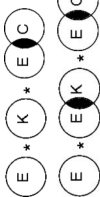


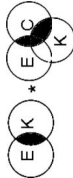
Although this approach represents a significant advance in the empirical assessment of risk, it nevertheless appears to be limited in certain ways. Indeed, the original formula is based on two building blocks: level of exposure to stress (E) and consequences of this exposure on various health outcomes (C). When compared to the occupational stress model (Cooper and Marshall 1976), it appears that a third and significant construct is missing, that is, the coping strategies of individuals when faced with stress sources. Indeed, according to the transactional theory of stress, exposure to a stressor produces strain only when it is appraised as exceeding individual resources to cope with it (Lazarus and Folkman 1984). Coping has been defined as 'the cognitive and behavioural efforts a person makes to manage demands that tax or exceed his or her personal resources' (Lazarus 1991: 5). Lazarus and Launier (1978) defined different coping strategies as ranging from more active (e.g. problem solving, information seeking, asking for support) to more passive and less adapted strategies (e.g. avoiding the problem). Clarke and Cooper (2000, 2004) point out that the same level of exposure to a stressor can have more or less impact depending on individual differences. However, because the evaluation of exposure to stress sources is subjective, they suggest that it is *ipso facto* related to the appraisal of stress sources and the resources to deal with them. Since the stress models consensually include moderators of the stress-strain relationship, the present article proposes to include the measure of coping strategies in the original formula proposed by Clarke and Cooper. Since coping strategies can be empirically assessed by various questionnaires, it is best to explicitly include coping in the calculation-of-risk formula (1) to test the Clarke and Cooper (2000) hypothesis and (2) to reflect the *moderator effect* of coping on stress outcomes.

Methods to introduce coping into the calculation of risk

There are many ways to include coping in the computation of the risk formula. Coping is usually assessed only on a per person basis, that is, each individual answering a general measure of coping, which is later investigated in terms of its relationship with other risk factors. Since coping is not assessed on a per risk factor basis, the psychometric consequence is that the coping score will act as a constant in the formula. Indeed, for every risk factor assessed, the coping level will be the same for each individual. Thus, it is necessary to find a way in which coping can contribute to the variance of the risk factors and be usefully added into the Clarke and Cooper formula. Four proposals for adding coping in the formula are described below. Table I resumes all four computations of the risk formula that includes coping:

- (1) The product of the original formula ($E \times C$) could be expanded to take into account the overall coping score, that is, $\text{risk} = E \times K \times C$, where E = exposure level, K = (non-adaptive) coping level and $C = R^2$ of the regression of stress exposure on stress outcomes. However, since the K factor does not vary within persons, it will act as a constant in this formula and, thus, will not contribute to the risk variance.
- (2) The product of the original formula ($E \times C$) could be computed with the association between stress exposure and coping: $\text{risk} = E \times K \times C$, where E = exposure level,

Table I. Overview of proposed computations of risk including coping

#	Representation	Exposure (E)	Coping (K)	Outcomes (C)	Problem(s)
1		Mean of exposure	Mean of non-adaptive coping	R^2 of the regression of stress exposure on stress outcomes	Coping does not contribute to risk variance
2		Mean of exposure	R^2 of the regression of stress exposure on non-adaptive coping level	R^2 of the regression of stress exposure on stress outcomes	The K factor is not related to outcomes, and only the strength of the relationship, not the level of coping, affect risk
3		Mean of exposure	R^2 of the regression of non-adaptive coping level on stress outcomes	R^2 of the regression of stress exposure on stress outcomes	The K factor does not contribute to risk variance
4		Interaction (product) of exposure mean and coping mean		R^2 of the regression of the interactive effect of stress exposure and coping (EK) on stress outcomes	The revised formula of risk assessment

- $K = R^2$ of the regression of stress exposure on non-adaptive coping level and $C = R^2$ of the regression of stress exposure on stress outcomes. However, this approach introduces biases in the computation of risk because (a) the association between exposure and coping does not add any information about the relationship between exposure and consequences, and (b) the association does not take into account the coping level. Thus, a high mean of adaptive coping will have exactly the same impact in the formula as a high mean of non-adaptive coping, because only the *strength* of the relationship between exposure and coping is important in this proposal.
- (3) The product of the original formula ($E \times C$) could be computed with the association between coping and stress outcomes: $\text{risk} = E \times K \times C$, where E = exposure level, $K = R^2$ of the regression of non-adaptive coping level on stress outcomes and $C = R^2$ of the regression of stress exposure on stress outcomes. However, this approach is limited by the fact that the association between coping and outcomes (K) does not vary across exposure to risk factors. So, coping still does not contribute to risk variance in the formula.
 - (4) The product of the interaction between exposure and coping (EK) could be computed and used in the calculation of the stress consequences: $\text{risk} = E \times K \times C$, where E = exposure level, K = non-adaptive coping level and $C = R^2$ of the regression of the interactive effect of stress exposure and coping (EK) on stress outcomes. This formula has many advantages over the previous ones: (a) it is conceptually similar to the original Clarke and Cooper (2000) formula since only the product of coping with other building blocks is added, (b) it introduces, in an effective and parsimonious way, the role of coping into the calculation of risk, (c) the coping *level* is taken into account, that is, if a person exhibits a high level of non-adaptive coping, the risk will be consequently increased, (d) coping contributes to the variance of the risk factor because it is included in the regression to estimate the consequences portion of the formula, and (e) the interactive effect of stress exposure and coping respects the formulation of the occupational stress model, where the coping is conceptualized as a moderator of the relationship between stressors and stress outcomes. These conclusions support this formulation as a new revised method to compute risk in occupational stress settings.

Algorithm of the revised risk assessment formula

In order to ensure proper computations of risk according to all requirements developed in the last section, operations are summarized in the following six steps:

- (1) *Exposure level for each risk factor on a 0 to 10 scale*: Compute the raw means of exposure level for each risk factor (means will vary according to the scale of each original questionnaire). To allow meaningful comparisons between factor exposure levels, transform raw mean of exposure for each risk factor into a 0 to 10 scale¹.
- (2) *Non-adaptive coping on a 0 to 10 scale*: Compute the raw means for each coping factor. Transform each coping level into a 0 to 10 scale according to the formula in (1) and compute the inverse for the *adaptive* coping factors (i.e. $MEAN_{\text{non-adaptive coping}} = 10 - MEAN_{\text{adaptive coping}}$). Compute the overall mean coping factor, which now represents a general non-adaptive coping factor (i.e. high score means more avoidance, less problem solving, less distraction, or less social support).

- (3) *Interactive effect of risk exposure and coping on a 0 to 100 scale*: Compute the product of risk exposure level (one score per factor) and coping level (one score per person).
- (4) *Risk consequences per factor on a 0 to 1 scale*: Compute a polynomial regression analysis between (a) the interactive effect of risk exposure and coping and (b) the various scales measuring the consequences of risk factors on mental health (e.g. psychosomatic symptoms, burnout, psychological distress). Clarke and Cooper (2000: 179) rightly stress the fact that non-linear relationships between exposure and consequence levels are not included in the correlation coefficient. In order to capture the non-linear effects of risk exposure on health consequences, the regression must include the raw consequences scores as well as the squared scores of each scale. The raw and squared scores of each outcome scale constitute a better estimate of the overall level of health consequences.
- (5) *The percentage of variance of consequences explained by the interactive effect of risk exposure and coping (R^2 , ranging from 0 to 1)* is obtained for each factor, which constitutes the consequence level of the risk factor on physical and mental health.
- (6) *Risk level of each factor*: Compute the product of the interactive level of exposure and coping (EK) and the consequence level (C) for each factor. You should obtain a 0 to 100 score for each risk factor.
- (7) *Ranking of risk factors*: All the risk factors should simply be ranked in decreasing order (the highest to the lowest level), and sorted into three categories (i.e. three thirds), that is, factors exhibiting *high, medium, and low* risk for mental and physical health.

Among the advantages of this approach, it allows a consultant or a researcher to compare assessed risk factors *within* an occupational group and an organization, in order to identify those factors associated with the highest risk and probability of impact on organizational health. This procedure has been labelled as the *relative* comparison approach. While it is probably not the most useful approach, it has the important advantage of being simple and straightforward to implement in any organizational setting. The other approach is the *normative* comparison approach, that is, the comparison of each risk level with normative data, as proposed by Clarke and Cooper (2000, 2004). However, to compute these norms, one would need a large sample of organizations, not persons (i.e. hundreds of organizations), all assessed using exactly the same stress exposure, coping, and outcomes scales. As Clarke and Cooper (2004) acknowledged, the bulk of these computations remains to be done. Hence, the relative comparison approach constitutes a more realistic and practical method to identify the highest factors during risk assessment procedures in organizational settings.

Method

Participants

The data were collected from a hospital centre during the winter of 2004. Union representatives of each job category were met and had to agree to participate in order for the employees to receive a questionnaire. The clerical group had recently participated in a study on stress, so this group was not solicited (a few people indicated they belonged to this category but they probably held more than one status). Out of 2014 employees who received the questionnaire, a total of 1229 employees completed it, a response rate of 61.0%.

They were informed that their participation in the study was voluntary and that their responses would remain confidential. They were not remunerated or compensated for answering the questionnaire.

The mean age was 42 years old ($SD = 10.6$) and most participants were female ($n = 1078$, 88.7%). Concerning employment status, 773 (63.4%) were permanent and employed full-time, while 333 (27.3%) were permanent but working part time and 114 (9.4%) were non-permanent. A total of 606 (49.9%) were nurses or in care-giving occupations, 330 (27.2%) were employed as technicians, 170 (14.0%) as professionals, and 83 (6.8%) as managers. The sample included 25 (2.0%) respondents in the clerical group or in other categories and 15 (1.2%) failed to specify their job category².

Instrument

The questionnaire assessed a variety of psychosocial (e.g. workload, roles, relationships, rewards, skill discretion, decision authority, work–family conflicts) and physical (e.g. security problems, exposure to toxic agents³, meteorological conditions) work hazards. Diverse psychological consequences were also measured (i.e. psychological distress, emotional exhaustion, psychosomatic complaints). For a complete description of the psychometric properties of the scale included in the questionnaire, see Biron, Brun, and Ivers (in press) or Brun, Biron, Martel, and Ivers (2003). The scales originally formulated in a positive direction (e.g. harmonious relationships at work) were reversed, so a high score indicates a higher exposure to the stressor (e.g. non-harmonious relationships at work). The same operations were performed on scales measuring psychological and physical consequences.

The original 23 coping items proposed by Cooper, Sloan, and Williams (1988) were submitted to a rigorous factor reanalysis in order to reduce scale length and to increase internal consistency. Data from 1956 participants in a larger study were submitted to a principal factor analysis with oblique (*promax*) rotation to allow for inter-factor correlations. Using various standard criteria (i.e. parsimony of solution, Thurstone simple factor, scree break test), a four-factor solution was found, comprising problem solving, distraction, social support, and avoidance. Original items that exhibited low communalities or were redundant within a factor were dropped from the original scale (items 2, 4, 5, 13, 14, 20, and 21), yielding a 16-item scale. Factor analysis was completed a second time on the current sample ($n = 1194$) to reproduce previous results with an independent dataset. Using the same criteria, the same four factors, including the same items, were identified and respectively labelled problem solving (PS; items 8, 9, 16, 18, 19), distraction (DS; items 7, 12, 15, 17), social support (SS; items 6, 11, 23) and avoidance (AV; items 1, 3, 10, 22). The factor structure explains 44.4% of the total variance and moderate correlations between factors were found, ranging from $r = 0.18$ to 0.50 . Final communality estimates were above 0.30 for all but three items (items 10, 12, and 22, all ranging from 0.20 to 0.24). Internal consistency was good for the overall 16-item scale (Cronbach alpha = 0.85) and three subscales (PS = 0.82; DS = 0.81; SS = 0.73). However, the avoidance scale has a moderate alpha = 0.57 and examination of item-total correlations revealed that item 10 exhibits a low correlation ($r = 0.28$) with the total avoidance subscale. Because the coping scale assesses various types of coping, where some are adaptive (e.g. problem-solving, social support, distraction) but others are non-adaptive (e.g. avoidance, amplifying the problem), items were recoded in order to evaluate non-adaptive coping strategies (i.e. a higher score indicates more passive coping).

Results

Risk level was computed for four work categories using the original Clarke and Cooper (2000) formula and the proposed extended formula, detailed in the previous section. Because the findings were constant across all work categories, only data from the sample of nurses are shown in Table II.

Examination of these data revealed several facts. First, ranking of factors from both formulas exhibits a general agreement, that is, the highest and lowest risk factors appear to be generally the same, regardless of the formula used in risk assessment. This pattern was found in each work category. Considering the nurses for example, out of the six factors that exhibited the highest risks, four remain among the highest when the coping score is included in the formula (i.e. ‘work overload,’ ‘poor career opportunities,’ ‘low recognition by colleagues and superior,’ and ‘low participation in decision-making’). To investigate this conclusion, weighted kappas were computed between original and revised risk rankings. Results revealed that agreement was significantly different from random agreement for all work categories. Specifically, agreement was higher for managers ($k_w = 0.81$, 95% CI = 0.73–0.88) and professionals ($k_w = 0.76$, 95% CI = 0.66–0.86) and lower for nurses ($k_w = 0.58$, 95% CI = 0.37–0.79) and technicians ($k_w = 0.61$, 95% CI = 0.41–0.81). These data suggest that coping may have a greater effect on the relationship between risk exposure and stress outcomes in these latter work categories than in the former ones.

Second, the strength of the relationship between exposure and stress outcomes (the *C* factor) appears to be generally higher in the extended formula as compared to the original

Table II. Calculations of risk level per factor with the original Clarke and Cooper (2000) formula and the proposed extended formula for the nurses’ sample ($n = 660$)

Risk factor	Original formula ($E \times C$)				Extended formula ($E \times K \times C$)			
	<i>E</i>	<i>C</i>	Risk	Rank	<i>EK</i>	<i>C</i>	Risk	Rank
Work overload	49.46	0.37	18.06	1	21.99	0.41	9.11	1
Poor career opportunities	54.77	0.14	7.52	2	24.63	0.24	5.87	2
Low recognition by colleagues and superior	45.09	0.13	6.02	3	20.08	0.24	4.88	4
Security problems	48.31	0.11	5.12	4	21.48	0.19	3.98	8
Role conflict	22.67	0.19	4.34	5	10.13	0.29	2.95	12
Low participation in decision-making	53.61	0.07	3.77	6	23.88	0.18	4.41	5
Poor relationships with employees	41.76	0.09	3.74	7	18.22	0.17	3.05	11
Responsibility for people	79.04	0.05	3.60	8	34.87	0.16	5.62	3
Physical environment	27.92	0.13	3.54	9	12.40	0.19	2.40	15
Work–home conflict	38.11	0.09	3.48	10	17.07	0.17	2.93	13
Poor relationships with doctors	53.07	0.06	3.42	11	23.83	0.17	4.06	7
Poor relationships with superior	54.88	0.06	3.26	12	24.44	0.18	4.31	6
Low decision authority	47.68	0.06	3.03	13	21.49	0.17	3.73	9
Competition	42.26	0.07	2.90	14	19.01	0.15	2.77	14
Poor relationships with colleagues	38.31	0.07	2.49	15	17.44	0.19	3.23	10
Job insecurity	30.53	0.08	2.47	16	13.78	0.15	2.05	17
Role ambiguity	30.76	0.06	1.79	17	14.06	0.14	1.99	18
Poor relationships with clients	29.62	0.06	1.79	18	13.53	0.14	1.89	19
Poor relationships with other units	49.80	0.02	0.83	19	22.63	0.10	2.17	16
Low skill discretion	27.78	0.02	0.53	20	12.44	0.07	0.93	20

Note: Scales are, respectively, Exposure (*E*) = 0 to 100, Exposure × Coping (*EK*) = 0 to 100, Consequences (*C*) = 0 to 1, Risk = 0 to 100, Rank = 1 to 20 (1 = highest risk).

formula (see Table III). Indeed, the mean level of the consequence (*C*) factor for all work categories was 0.15 for the original formula but increased to 0.24 for the extended formula. These data suggest that the inclusion of coping in the risk assessment formula effectively increases the strength of the relationship between risk exposure and stress outcomes, thus providing a more reliable and valid way to assess risk.

Discussion

As organizations face the challenge of developing policies and interventions to manage workplace stress, they are increasingly interested to complete risk assessment. As Cox (2000) specifies, it is necessary to carry out such an organizational diagnosis before implementing organizational interventions in order to ensure that the selected strategies effectively address employees' sources of stress. Clarke and Cooper (2000) propose a risk management methodology that can be implemented to identify hazards and assess the level of risk associated with those hazards. This approach, coupled with the use of validated instruments, is informative and often cost-effective since it allows the organization to identify and rank risk priorities. These can then be associated with specific organizational solutions. The aim of the present article was to assess empirically the feasibility and advantages of the addition of a coping score to the original Clarke and Cooper formula.

The inclusion of the coping score offers several interesting perspectives for risk assessment of workplace stress. First, by reflecting the moderator effect of coping on the relationship between events and stress outcomes, the revised formula offers a better fit with the occupational stress model proposed by Cooper and Marshall (1976) as well as with the transactional theory of stress (Lazarus and Folkman 1984). Indeed, individuals are likely to take action to cope with the stressors instead of remaining passive when confronted with a situation that they perceive as threatening.

Second, from a more pragmatic perspective, the revised formula produces more realistic results, which differ from the ones obtained issued with the original formula. Since the main objective of risk evaluation is to indicate where an organization should focus its efforts in the development of interventions to prevent work stress, efforts and resources should target the most potential factors associated with consequences for personal and organizational health. As illustrated in Table II, the inclusion of coping in the formula modifies the ranking of risk factors, thus transforming the hierarchy of targets for interventions. For example, the factor concerning security problems was ranked fourth in the original formula, but the inclusion of coping brings this factor to the eighth rank. This suggests that, compared to other risk factors, the nurses perceive their ability to cope with the risk of being involved in an accident at work as being quite high. This example illustrates the role of coping as a buffer, which actually reduces the overall risk associated with security aspects of nurses' work.

Table III. Variations in the levels of consequences (i.e. R^2) according to original and extended formulas for each work category

	Original formula	Extended formula
Managers	.22	.35
Nurses	.10	.19
Professionals	.19	.26
Technicians	.10	.16
Mean across work categories	.15	.24

However, this 'protection' may act in the opposite direction. For example, the factor 'Responsibility for things and people' assesses the extent to which an error in judgment or in behaviour may have major negative consequences. This factor was ranked eighth using the original formula but rose to the third rank with the inclusion of coping level, suggesting that their ability to cope with this stressor, as compared with security problems, puts them more at risk of experiencing work strain. Thus, it can be seen that this revised formula allows the organization to consider the strategies used by employees to cope with work stress, which helps to determine more precisely where efforts and resources in prevention should be directed.

A third advantage of the extended method concerns the normative aspects of standard assessment procedures. Clarke and Cooper (2000, 2004) as well as Faragher, Cooper, and Cartwright (2004) state that to be effective, stress evaluation should be compared to published normative values, allowing organizations to benchmark themselves against comparable work populations. However, since such norms are often not available in many work groups and countries, our approach proposes a *relative* comparison instead of a normative one. The relative comparison makes it possible (1) to compare different groups within an organization and (2) to identify which stressors are the most problematic within a group or for all groups combined. As illustrated by Sparks and Cooper (1999) as well as by Brun and colleagues (2003), there are occupational differences in the work-strain relationship. Therefore, it seems wise to identify the intervention priorities on a per-occupation basis. Finally, since the extended formula is based on relative comparison within groups, the computation of risk factors could be tailored according to the specific needs of an organization. For example, the hierarchy of risk factors may be computed for a subset of participants, by age group, or by department. This flexibility is, of course, usually not possible when normative risk assessment is implemented because of the tremendous amount of work necessary to produce norms for all actual or future sample characteristics.

There are, of course, some limitations to the present methodology. A first limitation concerns the use of a global score derived from the coping scale. If the multiple coping factors are included in the Clarke and Cooper (2000) formula, the contribution of the coping measures to the overall variance of risk will not be proportional to other components (exposure and consequences). Thus, a unique factor scale (one global score) appears to be the most appropriate coping measure for risk assessment. As noted by Sparks, Faragher, and Cooper (2001), there has been considerable discussion around the use of coping as a one-dimensional construct. Many different taxonomies of coping have been proposed (see Cooper *et al.* 2001 for example), but even the use of factor analysis in the elaboration of these taxonomies has been criticized since it might not reflect the complexities of the coping process (Dewe 2003). The research purpose here is not to advance our understanding of the coping processes but rather to propose a more refined way of calculating risk, in order to better inform organizations about the areas that should be given priority. Many researchers have demonstrated the positive relationship between the use of active coping and well-being (Parkes 1990, Koeske *et al.* 1993, de Rijk *et al.* 1998), and thus it is relevant to include it in the formula as a unique score.

Since some researchers have found a high degree of consistency in the use of coping strategies across a range of different role stressors (Latack 1986), the rationale behind averaging all items of a coping checklist comes from the observation that a mean score might reflect a general tendency to cope in a more or less adaptive manner with work stress. As Folkman (1991) indicates, the use of factor analysis and the computation of mean coping scores produce coping categories that have empirical and conceptual integrity. However, researchers have pointed out the limits of using mean scores of coping checklists

(Aldwin 1994, O'Driscoll and Beehr 1994, Dewe 2003). Among the problems noted, critics argue that this approach is generally too simplistic to adequately reflect the strategies individuals will use to cope with everyday life circumstances (Aldwin 1994). The difficulties associated with the use of mean scores are mainly related to the interpretation of such scores for the prediction of specific behavioural outcomes: the very same coping strategy might be adaptive in a certain context but maladaptive in another situation.

Even though the instrument used in the present study specifically examines coping strategies strictly in the work context, some might argue that individuals do not cope consistently with different problems and within a role domain (e.g. at work). It seems plausible that a more ecologically sensitive, person- and meaning-centred method for measuring coping might better capture the processes of coping but, as such, these methods also produce more complex results, which are harder to interpret and harder to implement in the context of risk assessment procedures. As Brief and George (1991) point out, an individually based approach may not provide the level of analysis necessary to identify those working conditions likely to affect the well-being of *most* workers (16).

A second limit is related to the assessment of the coping strategies. There is an implicit assumption that, when using Likert self-report measures, 'the endorsement of more items necessarily implies greater coping effort and hence a greater effect on outcome' (Parkes 1994: 120). However, the nature of the coping process itself may not justify such an assumption (Cooper *et al.* 2001). According to Stone and Kennedy-Moore (1991), high inter-item covariance is not usually expected in coping scales. While it is acknowledged that psychometric investigation of coping measures using traditional tools might be questionable (Coyne and Gottlieb 1996), we did not experience these problems in the present study. Indeed, the reliability coefficient of the global coping scale, calculated from two samples including a large number of respondents, was respectable ($\alpha = 0.80$ and 0.85).

Conclusion

For practitioners and researchers wishing to use the proposed method to carry out risk evaluations, it should be clear that this strategy constitutes one step of the risk assessment, but not the sole step. Qualitative methodologies are also very useful to refine the diagnosis for particular groups of employees in order to gain a better understanding of the processes underlying the results. Since the statistical analyses necessary to calculate the risk levels imply relatively large samples of respondents, qualitative methodologies like focus groups may be a more advantageous solution in small organizations or small departments.

Even though methods of measuring risks and stress outcomes might be refined, the theoretical and practical value of including a coping score in risk assessment of work stress constitutes a significant contribution in stress research. This extended formula may be seen as a step toward a more effective assessment methodology of occupational stress, based on a more solid theoretical ground. Future research should consider how to include more refined coping scores that better reflect the idiosyncrasy of coping processes, as well as other components relevant to stress models. Indeed, other moderators of the stressor-strain relationship could be investigated as additional building blocks to the risk formula.

Notes

- 1 This transformation is straightforward: (a) subtract a constant to get a minimum score of zero, (b) divide the result by the maximum score of the corrected scale, and (c) multiply the resulting score per 10 to get a 0 to 10 score. For example, if we have a mean of 3.5 on a '1 to 7' scale, we need to do these operations: $(3.5 - 1) / 6 \times 10 = 4.17$.

- 2 Clerks and the respondents from 'other categories' were not included in the analysis.
- 3 Respondents had to indicate whether or not they were exposed to toxic agents, no details were obtained concerning which type of toxic agents.

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