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Research Report

Stress and Psychological Health: Testing the Mediating Role of Cognitive Appraisal

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Abstract

This study tested the mediating role of primary (e.g., threat and challenge perceptions) and secondary (e.g., coping potential and control perception) cognitive appraisal in the relationship between occupational stress and psychological health. This mediation was tested using a cross-sectional study based on self-reported measures. The total sample consisted of 2,302 nurses, 1,895 females (82.3%) and 407 males (17.7%), who completed an evaluation protocol with measures of occupational stress, cognitive appraisal, and psychological health. To test the mediating role of cognitive appraisal in the relationship between cognitive appraisal and psychological health, we used Structural Equation Modeling (SEM). The results confirmed that primary and secondary cognitive appraisals partially mediated the relationship between occupational stress and psychological health; however, the direct effects of stress on psychological health cannot be ignored. The findings indicated that cognitive appraisal is an important underlying mechanism in explaining adaptation at work.

Keywords

anxiety, stress, cognitive appraisal, nurses, mental health

Stress and Psychological Health: Testing the Mediating Role of Cognitive Appraisal

Occupational stress can be understood as a set of demands that individuals face at work and perceive as exceeding their abilities and resources and, thus, lead to negative outcomes (Lazarus, 1991). These negative consequences from exposure to work stress can be psychological and/or physical outcomes. For example, mental health, as a state of emotional, psychological, and social well-being, can be affected by work conditions (Cottini & Lucifora, 2013). Existing evidence shows that health professionals are at high risk for experiencing occupational stress and psychological problems (Mark & Smith, 2012). In fact, health professionals' work activities are associated with high occupational stress because these professionals must face different sources of pressure, such as long work days, workload, interpersonal relationships, patient care, time pressure, sleep deprivation, low tolerance for error, limited resources, and bureaucratic-political constraints (Lee & Wang, 2002; for a review, see Riahi, 2011). These problems have had significant effects on nurses, resulting in depression, burnout, job dissatisfaction, turnover, and severe chronic fatigue (Adriaenssens, Gucht, & Maes, 2015; Bakker & Heuven, 2006; Imai, Nakao, Tsuchiya, Kuroda, & Katoh, 2004; Shanafelt, Bradley, Wipf, & Back, 2002).

These indications of literature highlights the importance of analyzing nurses' work conditions and the consequences of "unhealthy environments" for their well-being. In addition, the mechanisms that explain the emergence and development of occupational stress must be examined to address the important challenge of understanding human adaptation to work conditions.

One such mechanism is cognitive appraisal, which represents the process by which an individual evaluates or judges the personal meaning of a potentially stressful event and

the event's importance for his or her well-being (Lazarus & Folkman, 1984). Cognitive appraisal indicates whether a stressful event is perceived as good or bad for the individual, which in turn depends on how the individual evaluates the situation (primary cognitive appraisal) and the way in which the individual copes (secondary cognitive appraisal). Thus, cognitive appraisal is a central concept in understanding human adaptation to stressful events. However, findings of how cognitive appraisal affects adaptation to work conditions (Ohly & Fritz, 2010; Paškvan, Kubicek, Prem, & Korunka, 2016), particularly high-risk activities such as those performed by nurses, are scarce. As discussed by Glaser and Hecht (2013), surprisingly little is known about personal characteristics (such as cognitive appraisal) that make individuals more or less resilient to the negative effects of work. Considering these aspects, this study analyzes whether cognitive appraisal mediates the relationship between occupational stress and psychological health in a sample of nurses.

The concept of cognitive appraisal used in this study is derived from Cognitive Appraisal Theory (Lazarus & Folkman, 1984), which assumes that the work reactions of stress and distress are not caused by the individual or the work environment alone but, rather, result from a functional combination of the two factors (Lazarus & Cohen-Charash, 2001). This concept suggests that when a stressful event occurs, the individual must assess the importance of the situation for his or her well-being, and only events considered relevant have the potential to cause stress or strain or, by contrast, can result in a positive personal growth experience (Gomes, 2014). After importance is attributed to a stressful event, two processes of primary cognitive appraisal occur (Lazarus, 1999).

First, the individual evaluates whether the situation is a threatening or a challenging situation. If the individual evaluates the situation as overwhelming his or her ability to cope, then the stressful event may be perceived as threatening. By contrast, if the

individual evaluates that he or she can address the situation using his or her coping skills, then the stressful event tends to be perceived as challenging. Second, processes of secondary appraisal, which represent a global evaluation of the individual's coping resources and ability to manage the demands of the stressful situation, come into play (Folkman & Lazarus, 1985). When individuals feel as though they have sufficient abilities to manage the situation (coping potential) and have some control over the stressor and demands of work (control perception), they can better adapt to the stressful situation (Troup & Dewe, 2002; Schellenberg & Bailis, 2016; Unruh, & Nooney, 2011).

Considering the dynamic processes established between primary and secondary cognitive appraisals, occupational stress is considered to occur when professionals must cope with situations in which job demands related to the work environment are perceived to exceed the worker's coping resources (Dewe, O'Driscoll, & Cooper, 2013). In the case of health professionals, evidence shows that nurses must face a large number of job demands and have few available external resources (Bourbonnais, Comeau, & Vézina, 1999; Circenis & Millere, 2012; Demerouti, Bakker, Nachreiner, & Schaufeli, 2000; Kirwan, Matthews, & Scott, 2013). Therefore, it becomes important to analyze the processes of cognitive appraisal, namely, how nurses evaluate their work activity and the coping resources and control they possess to manage work problems. In this study, the Cognitive Appraisal Scale (CAS; Gomes & Teixeira, 2016) was used to evaluate primary cognitive appraisal (e.g., work importance, threat perception, and challenge perception) and secondary cognitive appraisal (e.g., coping potential and control perception).

The other two variables introduced in this study were occupational stress and psychological health. In terms of occupational stress, the study evaluated both general (e.g., relationships at work and home-work interface) and specific (e.g., leading training activities and dealing with clients) sources of occupational stress among nurses (Gomes

& Teixeira, 2016). In regard to psychological health, the study evaluated particular symptoms and behaviors related to nurses' mental health problems (Goldberg, 1972; Goldberg & Williams, 1988).

Considering these aspects, the main goal of this study was to analyze the mediating role of cognitive appraisal in the relationship between occupational stress (as an antecedent variable) and psychological health (as a consequence variable). More specifically, the study determined whether cognitive appraisal influences the relationship between health professionals' perception of their work conditions (e.g., sources of stress) and mental health problems (e.g., psychological health). To investigate the transactional process between stress, cognitive appraisal, and psychological health, we formulated two hypotheses.

First, the direct relationship between stress and cognitive appraisal on the nurses' psychological health was tested. Specifically, hypothesis 1 stated that stress is positively related to mental health problems; threat perception is positively related to mental health problems; and challenge perception, coping potential, and control perception are all negatively related to mental health problems (see Figure 1). Of note, in this study, occupational stress represents a set of demands that nurses encounter in their work, and psychological health represents mental health problems that are not directly derived from work. For this first hypothesis, we assumed a relationship between stressor and strain, which has been supported by theoretical frameworks (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001; French, Caplan, & Harrison, 1982; Kahn & Byosiere, 1992; Karasek & Theorell, 1990) and empirical findings demonstrating the relationship between stress and psychological health (for a review, see Lundberg & Cooper, 2011). Additionally, we assumed that different patterns of cognitive appraisal are related to better or worse psychological health in nurses (Lazarus, 1999).

Second, hypothesis 2 stated that cognitive appraisal mediates the relationship between occupational stress and psychological health (see Figure 2). Mediation is assumed when the mediator variable reduces (partial mediation) or eliminates (full mediation) the link between the independent and dependent variables (Baron & Kenny, 1986). Thus, a partial mediation model (which assumes direct paths from stress to cognitive appraisal) and a full mediation model (which removes the direct path from stress to psychological health) were tested. Several previous studies have demonstrated the mediating role of cognitive appraisal in the relationship between different variables, such as stress and burnout (Gomes, Faria, & Gonçalves, 2013), stress and psychophysiological reactions (Goh, Sawang, & Oei, 2010), resilience factors and psychological distress (Schaubroeck, Riolli, Peng, & Spain, 2011), and combat exposure and psychological distress (McCuaig Edge & Ivey, 2012). However, in this study, the mediating effect of cognitive appraisal was tested using a multidimensional measure of both primary and secondary cognitive appraisal, which is still not frequently used in occupational stress research (Carpenter, 2016). Furthermore, we considered a measure of psychological health that does not represent a specific and direct indicator of the negative consequences of work for individual well-being (such as the case of burnout, work commitment, and turnover) as an outcome variable. Thus, to the best of our knowledge, this is the first study to test these specific mediating relationships.

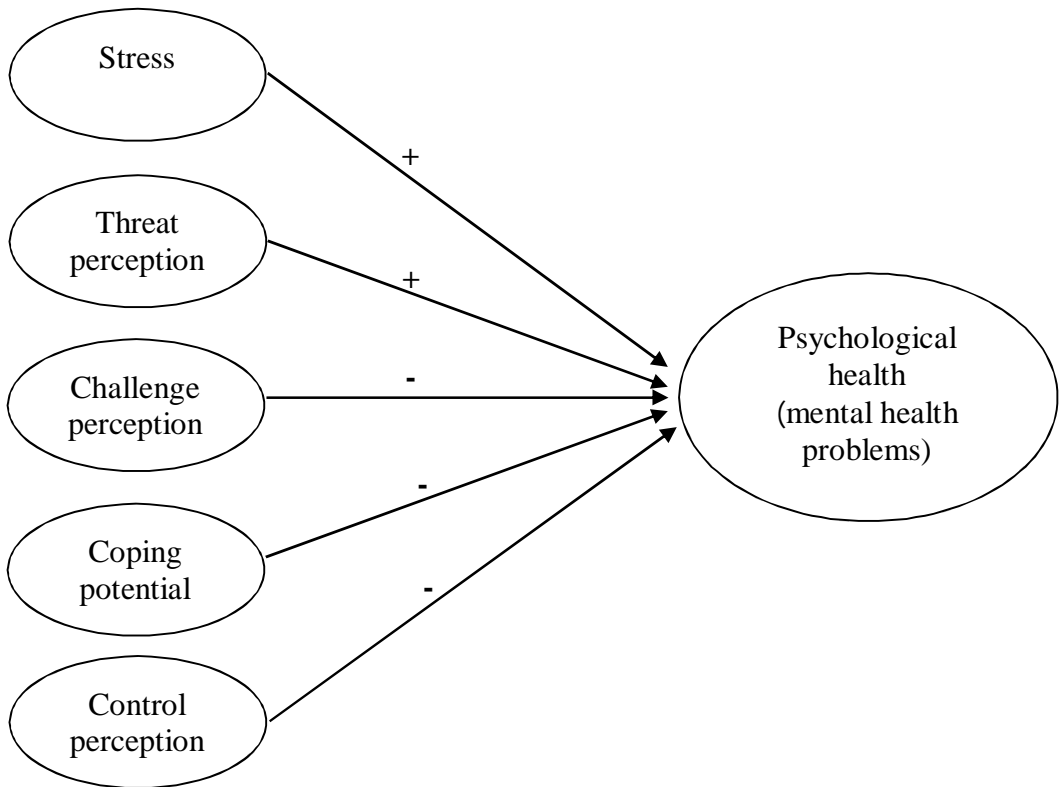


Figure 1. The direct model.

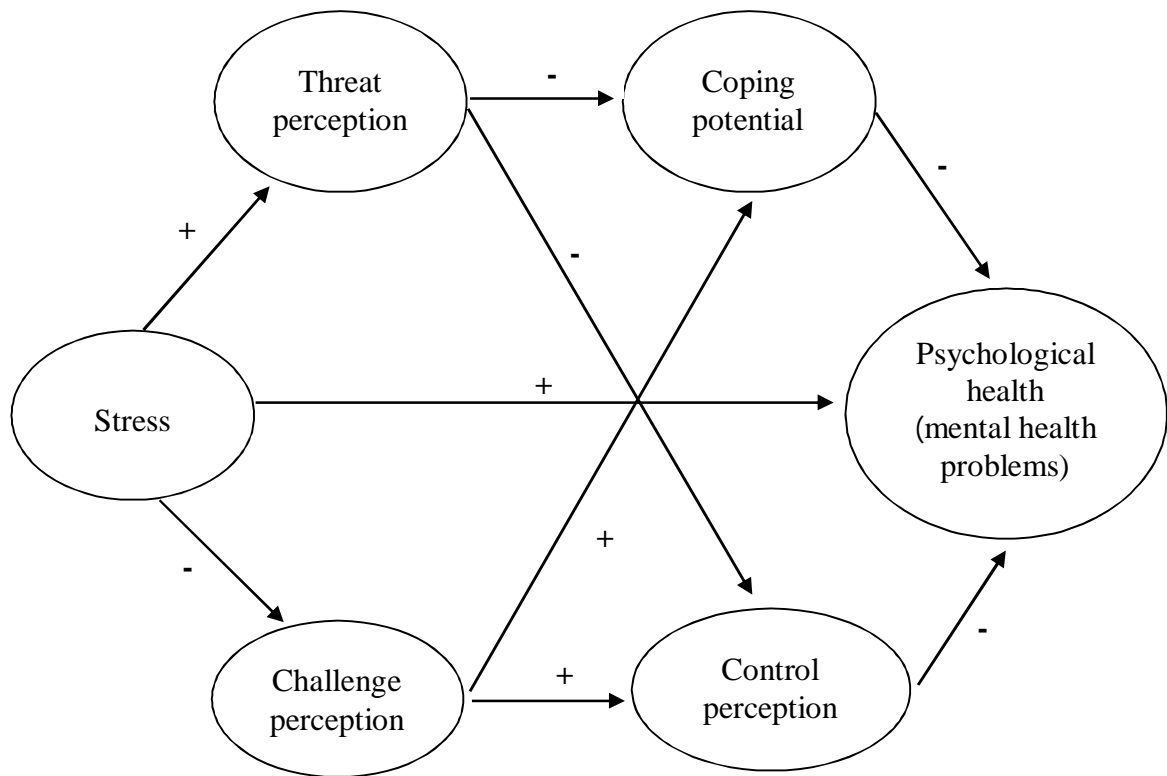


Figure 2. The mediation model.

Methods

Participants

The total sample consisted of 2302 nurses, 1895 females (82.3%) and 407 males (17.7%). The participants' ages varied between 21 and 66 years old ($M = 33.75$ years; $SD = 9.42$ years). Nurses worked for the public service of national health of Portugal, including mainly the contexts of hospital care (57.1%) and primary health care where outpatients from hospitals are treated (15.1%); the remaining participants did not provided information about their workplace. The participants primarily worked in medical specialties (36.3%), emergency and intensive care (11.1%), and surgical specialties (10.1%); the remaining participants did not provided information about their clinical specialty. The majority of the participants (1481; 64.3%) worked rotating shifts, and most of them had a permanent/full contract (69.5%).

Measures

Stress Questionnaire for Health Professionals (SQHP; Gomes & Teixeira, 2016).

The SQHP evaluates the sources of stress that health professionals face in their activities. It includes 25 items distributed across the following six stress dimensions: (a) dealing with clients (e.g., “Managing serious problems of my clients”), (b) work overload (e.g., “Lack of time to perform all of my activities”), (c) career progression and salary (e.g., “Lack of opportunities for career development”), (d) relationships at work (e.g., “Interpersonal conflicts with my colleagues”), (e) leading training activities (e.g., “Carry out training activities under my responsibility”), and (f) home-work interface (e.g., “Lack of time to be with family/friends”). The items were measured on a 5-point Likert scale (0 = *No stress*; 4 = *High stress*). For each scale, the score was obtained by summing the item values and then dividing the result by the number of items in the scale. Therefore, high scores on each scale indicate greater perceived stress. Confirmatory factor analysis showed that the six-factor model had acceptable fit ($\chi^2(259\ df) = 2072.354, p < 0.001$; RMSEA = 0.055, 90% C.I. [0.053; 0.057]; CFI = 0.929; NFI = 0.920; TLI = 0.918).

Cognitive Appraisal Scale (CAS; Gomes & Teixeira, 2016). The CAS evaluates the primary and secondary processes of cognitive appraisal. Primary cognitive appraisal was assessed with the following three dimensions: (a) work importance (e.g., “My job... means nothing to me/means a lot to me”), (b) threat perception (e.g., “My job... is not disturbing to me/is disturbing to me”), and (c) challenge perception (e.g., “My job... is not exciting for me/is exciting for me”). Secondary cognitive appraisal was assessed with the following two dimensions: (d) coping potential (e.g., “To what extent do you think you are prepared to handle the demands of your job?”) and (e) control perception (e.g., “To what extent do you feel that what happens in your job depends on you?”). Each item was measured using a 7-point Likert scale, with the response scale coding adapted for

each question (some examples include 0 = *Not at all important to me*; 6 = *Very important to me* for work importance; 0 = *Not at all prepared*; 6 = *Well prepared* for coping potential). For each scale, the score was obtained by summing the item values and then dividing the result by the number of items in the scale. Therefore, high scores on each scale indicate greater perceived work importance, threat perception, challenge perception, coping potential, and control perception. Confirmatory factor analysis showed that the five-factor model had acceptable fit ($\chi^2(80\ df) = 555.785, p < 0.001$; RMSEA = 0.051, 90% C.I. [0.047; 0.055]; CFI = 0.974; NFI = 0.970; TLI = 0.966).

General Health Questionnaire-12 (GHQ-12; Goldberg, 1972, Goldberg & Williams, 1988; Portuguese translation by McIntyre, McIntyre, & Redondo, 1999). This instrument is one of the most well-known and used self-report measurements of general psychological health, which is an indicator of mental health. The GHQ-12 is used to evaluate changes in affective and somatic symptoms relative to typical levels of health (e.g., “Have you recently been feeling unhappy and depressed?”). The version used in this study contains 12 items, and the responses are answered on a 4-point scale (e.g., 1 = *Better than usual*; 4 = *Much less than usual*). Higher scores indicated more mental health problems. Confirmatory factor analysis showed that the two-factor model had acceptable fit (e.g., anxiety/depression and social dysfunction): $\chi^2(53\ df) = 941.249, p < 0.001$; RMSEA = 0.085, 90% C.I. [0.080; 0.090]; CFI = 0.912; NFI = 0.907; TLI = 0.890.

Procedure

This study was conducted in accordance with the internal guidelines of the Research Center of Psychology in our university and conformed to both national and European regulations regarding research with human participants and the management of personal data. We initiated this research by contacting the Portuguese Professional Association of

Nurses (PPAN) to present the research goals and the procedures to collect the data. An online questionnaire was sent to each participant, and all participants had to provide their consent before participating in the study. All nurses working in Portugal were invited to participate in this study. In total, 62566 nurses were registered in the PPAN, and 2310 nurses (3.7%) responded to the evaluation protocol.

Data Screening

We first analyzed the data to identify missing data and participants who attributed low importance to work activity. In regard to the latter cases, emotions and efforts to adapt to stressful situations only occur if individuals appraise the situation (i.e., the work activity) as significant and personally relevant (Gomes, 2014). In other words, relevance is crucial for all emotions (Lazarus, 1991) and, in our case, is crucial for understanding adaptation to stress at work. Thus, the relationships between stress, cognitive appraisal, and psychological health was tested for participants who attributed some importance to work. Eight participants were excluded because their questionnaires were not fully completed (more than 10% of the data were missing) or they selected values less than or equal to two points on the Likert scale of the work importance dimension of CAS, resulting in a final sample of 2302 participants.

Then, a data screening analysis was conducted to detect univariate and multivariate outliers (Tabachnick & Fidell, 2007). Standardized z-scores were inspected, and those larger than 3.29 ($p < 0.001$) were removed. Cases with a Mahalanobis distance greater than $\chi^2_{(12)} = 32.91$ ($p < 0.001$) were also removed. This strategy led to the removal of forty participants from the initial sample of 2302 participants; thus, the data of 2262 participants was tested in the set of analysis described below.

Data Analysis

Structural equation modeling (SEM) was used to test the hypotheses. The analysis consisted of two steps. In the first step, we tested the measurement model to assess its construct validity. In the second step, the structural models were tested. All analyses were conducted in AMOS 21.0.

Maximum likelihood (ML) estimation methods were used. To assess model fit, we used the χ^2 goodness-of-fit statistic, the root mean square error of approximation (RMSEA, Steiger, 1990), the Tucker-Lewis index (TLI, Tucker & Lewis, 1973), the Normed Fit Index (NFI, Bentler, 2007), and the comparative fit index (CFI, Bentler, 2007). The cut-off criteria used in this study followed generally accepted criteria described in the literature: RMSEA values < 0.05 indicate excellent fit, ≤ 0.08 acceptable fit; TLI values greater than 0.90 indicate acceptable fit; NFI values greater than 0.95 indicate excellent fit and those ≥ 0.90 are interpreted as good; CFI values close to 0.95 indicate excellent fit and those ≥ 0.90 are interpreted as good (Bentler, 2007). We also used the χ^2 difference test to compare the fit of nested models. Finally, the bootstrap procedure of AMOS was used to obtain 95% confidence intervals (CIs) around parameter estimates (MacKinnon, Fairchild, & Fritz, 2007). Bootstrapping is considered a powerful resampling method for obtaining parameter estimates and confidence intervals when variables are assumed to be normally distributed. We used bootstrapping with 1000 samples and a 95% CI and bias-corrected CIs.

To reduce chance capitalization, we randomly divided the total sample into an exploration sample (Sample 1, $n = 1131$), which was used to test the measurement and structural models, and a model validation sample (Sample 2, $n = 1131$), which was used to cross-validate the final model. Alpha values were acceptable for all the dimensions of the three instruments: SQHP: dealing with clients (Sample 1, $\alpha = .72$; Sample 2, $\alpha = .75$);

SQHP: work overload (Sample 1, $\alpha = .80$; Sample 2, $\alpha = .81$); SQHP: career progression and salary (Sample 1, $\alpha = .85$; Sample 2, $\alpha = .85$); SQHP: relationships at work (Sample 1, $\alpha = .76$; Sample 2, $\alpha = .79$); SQHP: leading training activities (Sample 1, $\alpha = .87$; Sample 2, $\alpha = .86$); SQHP: home-work interface (Sample 1, $\alpha = .75$; Sample 2, $\alpha = .76$); CAS: threat perception (Sample 1, $\alpha = .79$; Sample 2, $\alpha = .79$); CAS: challenge perception (Sample 1, $\alpha = .89$; Sample 2, $\alpha = .90$); CAS: coping potential (Sample 1, $\alpha = .80$; Sample 2, $\alpha = .82$); CAS: control perception (Sample 1, $\alpha = .73$; Sample 2, $\alpha = .73$); GHQ: anxiety/depression (Sample 1, $\alpha = .84$; Sample 2, $\alpha = .84$); and GHQ: social dysfunction (Sample 1, $\alpha = .75$; Sample 2, $\alpha = .75$).

Results

Descriptive Values and Correlations between Variables

The means and standard deviations of the variables and spearman correlations between the variables for Sample 1 and Sample 2 are presented in Tables 1 and 2, respectively. The correlations between the stress dimensions displayed the expected relationships, as all correlations were positive. In addition, stress was positively related to threat perception and negatively related to challenge perception, coping potential, and control perception. Stress was positively related to anxiety/depression and social dysfunction. Of note, threat perception was positively related to anxiety/depression and social dysfunction. By contrast, challenge perception, coping potential, and control perception were all negatively related to anxiety/depression and social dysfunction.

Table 1. Means, Standard Deviations, Alpha Values, and Correlations between Stress (SQHP), Cognitive Appraisal (CAS), and Psychological Health (GHQ-12) (Sample 1, $n = 1131$)

Variables	M (SD)	1	2	3	4	5	6	7	8	9	10	11	12
1. SQHP: Dealing with clients	2.69 (.72)	--											
2. SQHP: Work overload	2.62 (.83)	.48**	--										
3. SQHP: Career progression and salary	2.81 (.82)	.27**	.41**	--									
4. SQHP: Relationships at work	2.43 (.78)	.38**	.44**	.36**	--								
5. SQHP: Leading training activities	1.98 (1.03)	.30**	.21**	.06*	.18**	--							
6. SQHP: Home-work interface	2.02 (.91)	.42**	.41**	.27**	.36**	.28**	--						
7. CAS: Threat perception	2.14 (1.28)	.19**	.34**	.18**	.36**	.08*	.18**	--					
8. CAS: Challenge perception	4.40 (1.22)	.09**	-.12**	-.17**	-.17**	-.02	-.03	-.33**	--				
9. CAS: Coping potential	4.87 (.76)	-.16**	-.21**	-.03	-.16**	-.18**	-.12**	-.33**	.21**	--			
10. CAS: Control perception	4.00 (1.08)	-.01**	-.19**	-.18**	-.22**	-.07*	-.06	-.34**	.33**	.37**	--		
11. GHQ: Anxiety/depression	2.77 (.68)	.14**	.24**	.20**	.27**	.09**	.18**	.32**	-.23**	-.21**	-.27**	--	
12. GHQ: Social dysfunction	2.11 (.40)	.08*	.27**	.22**	.28**	.05*	.16**	.42**	-.40**	-.28**	-.37**	.60**	--

* $p < 0.05$; ** $p < 0.01$

Table 2. Means, Standard Deviations, Alpha Values, and Correlations between Stress (SQHP), Cognitive Appraisal (CAS), and Psychological Health (GHQ-12) (Sample 2, $n = 1131$)

Variables	M (SD)	1	2	3	4	5	6	7	8	9	10	11	12
1. SQHP: Dealing with clients	2.73 (.74)	--											
2. SQHP: Work overload	2.62 (.84)	.47**	--										
3. SQHP: Career progression and salary	2.82 (.83)	.31**	.44**	--									
4. SQHP: Relationships at work	2.46 (.82)	.42**	.48**	.37**	--								
5. SQHP: Leading training activities	1.98 (1.02)	.28**	.27**	.13*	.22**	--							
6. SQHP: Home-work interface	2.04 (.91)	.43**	.39**	.34**	.41**	.27**	--						
7. CAS: Threat perception	2.17 (1.30)	.18**	.35**	.22**	.33**	.06*	.15**	--					
8. CAS: Challenge perception	4.43 (1.19)	.05*	-.14**	-.18**	-.14**	-.05	-.05	-.35**	--				
9. CAS: Coping potential	4.83 (.78)	-.18**	-.22**	-.09*	-.12**	-.18**	-.14**	-.33**	.27**	--			
10. CAS: Control perception	3.99 (1.04)	-.02*	-.17**	-.14**	-.21**	-.09**	-.06*	-.28**	.38**	.39**	--		
11. GHQ: Anxiety/depression	2.80 (.70)	.16**	.22**	.23**	.29**	.10**	.18**	.31**	-.24**	-.20**	-.26**	--	
12. GHQ: Social dysfunction	2.10 (.39)	.07*	.18**	.22**	.24**	.09**	.17**	.31**	-.31**	-.17**	-.28**	.58**	--

* $p < 0.05$; ** $p < 0.01$

Stress and Psychological Health: Preliminary Analysis

To simplify the models to be tested, we reduced the number of manifest variables in the analysis for the stress and psychological health dimensions. For this purpose, we analyzed the possibility of a second-order latent variable for the stress and mental health dimensions. This option is recommended for several reasons, namely, the resulting increase in factor reliability, increase in the possibility that factors are normally distributed, decrease in idiosyncratic variance, and decrease in the ratio of measured variables to subjects (Marsh, Richards, Johnson, Roche, & Tremayne, 1994). Regarding the stress dimensions, one item of the career progression and salary dimension was removed, and the confirmatory factor analysis revealed a good fit ($\chi^2(232) = 949.58, p < 0.001$; RMSEA = 0.052; CFI = 0.94; NFI = 0.91; TLI = 0.92). Additionally, for the psychological health dimensions, the confirmatory factor analysis revealed good fit of a single factor representing mental health problems ($\chi^2(47) = 157.40, p < 0.05$; RMSEA = 0.046; CFI = 0.98; NFI = 0.97; TLI = 0.97).

Measurement Models

The measurement model was tested in Sample 1. The fit of the 1-factor model with all 12 study variables loading onto a single latent variable was compared with that of a 6-factor model that included stress, threat perception, challenge perception, coping potential, control perception, and psychological health. The 6-factor model fitted well to the data $\chi^2(1001) = 2457.6, p < 0.01$; RMSEA = 0.036 ($p_{\text{close}} = 1.00$); CFI = 0.94; NFI = 0.90; TLI = 0.93, and its fit was superior to that of the 1-factor model ($\Delta\chi^2(66) = 11177.5; p < 0.001$). All standardized factor loadings were significant and ranged from 0.48 to 0.92. These results confirmed the validity of the 6-factor specified measurement model.

Testing the Structural Models

The structural models were tested to determine whether a mediated model exhibited a better fit than the direct effect models and which type of mediation (e.g., partial or full) better described the data. In the direct model, a relationship from stress and cognitive appraisal to psychological health was established. In the partial mediation model, the direct paths from stress to cognitive appraisal were added. Finally, in the full mediation model, the direct path from stress to psychological health was removed.

More specifically, the direct model established a relationship from stress, threat perception, challenge perception, coping potential, and control perception to psychological health. The mediated model established a relationship between stress, threat perception, challenge perception, coping potential, control perception, and psychological health. The partial mediation model added direct paths from stress to threat perception and to challenge perception, from threat perception to control perception and to coping potential, and from challenge perception to control perception and to coping potential and assumed no direct paths from threat perception to psychological health or from challenge perception to psychological health. The full mediation model assumed no direct paths from stress to psychological health. The fit indices of the three structural models are presented in Table 3.

The direct effects model showed nearly acceptable fit indices (RMSEA = 0.047, CFI = 0.89, TLI = 0.89) and the full mediation model showed acceptable fit indices (RMSEA = 0.042, CFI = 0.91, TLI = 0.90), but the partial mediation model, which included all direct and indirect effects, appeared to have the best fit (RMSEA = 0.042; CFI = 0.91; TLI = 0.91).

The difference in chi-square between the direct effects model and partially mediated model was significant ($\Delta\chi^2(3) = 502.57; p < 0.001$), indicating that the mediation effects

cannot be ignored. The difference in chi-square between the fully and partially mediated models was significant ($\Delta\chi^2(1) = 56.24; p < 0.001$), indicating that the direct effects cannot be ignored.

Based on the results from the model exploration in Sample 1, the partial mediation model was cross-validated in Sample 2. The fit indices of the partial mediation model showed good fit to the data (RMSEA = 0.040; CFI = 0.92; TLI = 0.91).

For the assessment of the invariance of the research model across the two samples, the partial mediation model was simultaneously tested with the data of the two samples, and all structural paths were constrained to be equal across samples. The fit of the resulting constrained multi-group model ($\chi^2(2165) = 6106.51$, RMSEA = 0.028, CFI = 0.92, TLI = 0.91) was compared with that of the freely estimated model ($\chi^2(2100) = 6031.36$, RMSEA = 0.029, CFI = 0.92, TLI = 0.91). Compared with the fit of the constraint model, the fit of the freely estimated model was not significantly worse ($\Delta\chi^2(65) = 75.15; p = 0.18$), demonstrating the invariance of the research model.

Table 4 presents the standardized effects for the partial mediation model, namely, the parameter estimates of the structural path coefficients and the squared multiple correlation coefficients. The estimates of the direct and indirect effects were based on 1000 bootstrap samples, and the corresponding 95% CIs of these bootstrap estimates are presented in parentheses. The partial mediation model explained 27% of the variance in threat perception, 5% of the variance in challenge perception, 20% of the variance in coping potential, and 26% of the variance in control perception. Furthermore, this model explained 27% of the variance in psychological health. The path coefficients and regression coefficients can be observed in Figure 3.

Table 3. Models 1 and 2: Fit Indices for the Three Structural Models and Validation.

Exploration on Sample 1 ($n = 1131$)						
Model	χ^2	df	RMSEA	P-close	CFI	TLI
1. Direct effects	3646.40	1054	0.047	1.000	0.89	0.89
2. Full mediation	3143.83	1051	0.042	1.000	0.91	0.90
3. Partial mediation	3087.59	1050	0.042	1.000	0.91	0.91
Validation on Sample 2 ($n = 1131$)						
Model	χ^2	df	RMSEA	P-close	CFI	TLI
3. Partial mediation	2946.27	1050	0.040	1.000	0.92	0.91

Table 4. Standardized Effects (95% Confidence Intervals) in Partial Mediation Models (Sample 2, $n = 1131$)

	Dependent variables					
	<u>Primary cognitive appraisal</u>		<u>Secondary cognitive appraisal</u>		<u>Psychological health</u>	
	Threat perception <i>b</i> (95% CI)	Challenge perception <i>b</i> (95% CI)	Coping potential <i>b</i> (95% CI)	Control perception <i>b</i> (95% CI)	Indirect effect <i>b</i> (95% CI)	Direct effect <i>b</i> (95% CI)
Stress	0.523** (0.451; 0.586)	-0.225** (-0.292; -0.150)			0.097** (0.069; 0.131)	0.290** (0.205; 0.368)
Threat perception			-0.340** (-0.426; -0.244)	-0.397** (-0.483; -0.303)		
Challenge perception			0.163** (0.084; 0.246)	0.344** (0.255; 0.438)		
Coping potential						-0.342** (-0.428; -0.243)
Control perception						-0.038 (n.s.) (-0.128; -0.044)
<i>R</i>²	0.27** (0.203; 0.344)	0.05** (0.022; 0.085)	0.20** (0.137; 0.263)	0.26** (0.192; 0.319)		0.27** (0.197; 0.331)

** $p < 0.01$

Notes: *b* = standardized estimate; CI = confidence interval

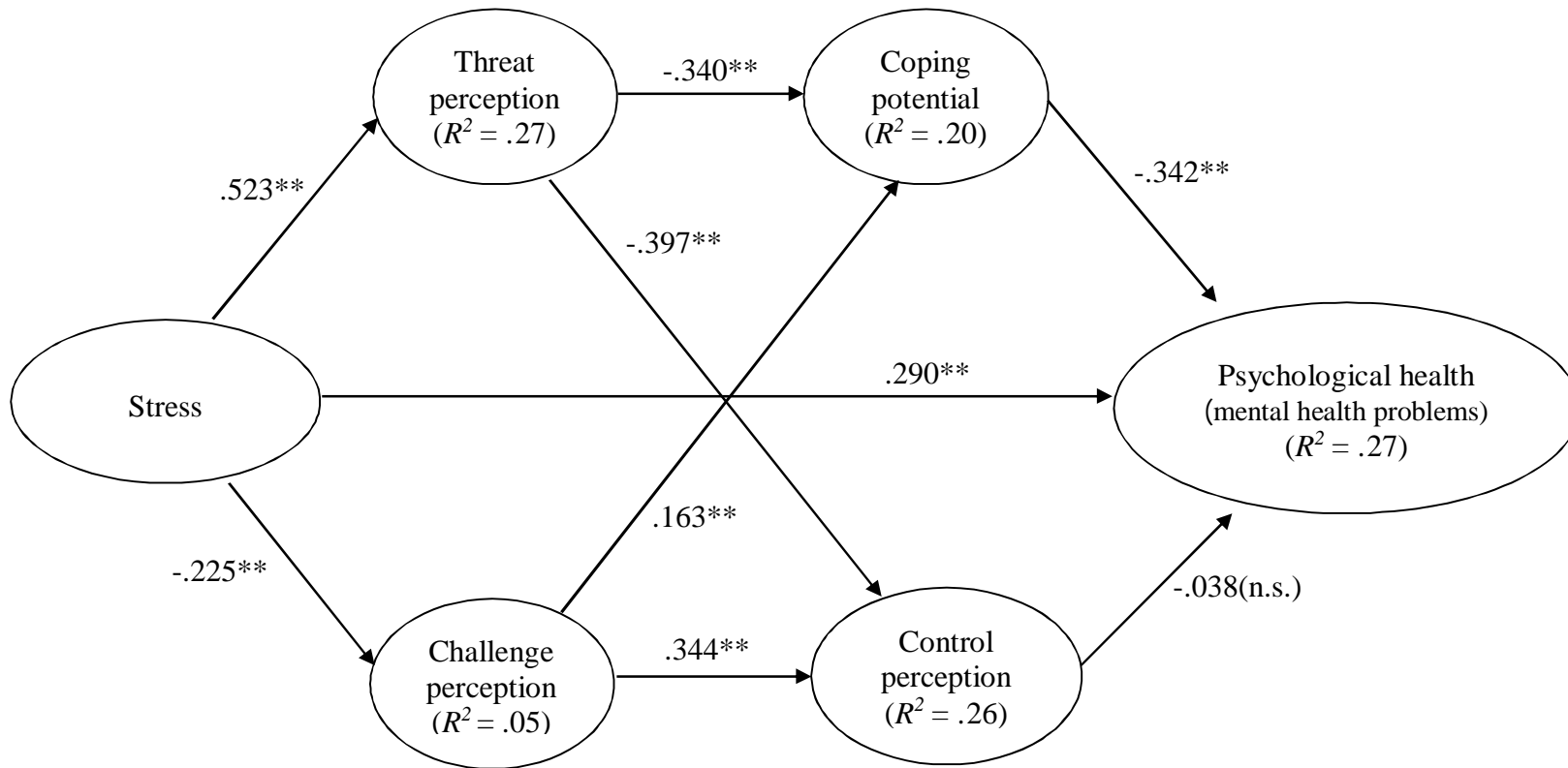


Figure 3. The partial mediation model: Adjusted model with standardized regression coefficients.

Discussion

This study analyzed the relationships between occupational stress, cognitive appraisal, and psychological health under the assumption that cognitive appraisal represents an important mechanism in explaining human adaptation to work contexts.

To test this assumption, we formulated two hypotheses. Hypothesis 1 tested the direct relationship between stress and cognitive appraisal and nurses' psychological health. The results confirmed this hypothesis, indicating that occupational stress and threat perception are positively related to nurses' mental health problems and that challenge perception, coping potential, and control perception are all negatively related to nurses' mental health problems. Regarding stress, the results demonstrated that more stress is associated with more mental problems and that stress displayed different relationships with different cognitive processes (i.e., it was positively associated with threat perception and negatively associated with challenge perception, coping potential, and control perception). These findings are consistent with several theoretical models, for example, the Demand–Control theory (Karasek & Theorell, 1990), which proposes that job demands (or stressors) have a main direct effect on both psychological and physiological strains. This impact was also evident for cognitive appraisal, which confirmed that nurses' evaluation of their jobs affects their psychological health. More specifically, threat perception was positively related to mental health problems, and challenge perception, coping potential, and control perception were all negatively related to mental health problems. These patterns of results are consistent with evidence that assumes that threatening or challenging processes of cognitive appraisal are associated with psychological well-being and health outcomes, such as job satisfaction and sickness absence (Verhaeghe, Vlerick, Gemmel, Van Maele, & De Backer, 2006), anxiety (Kausar

& Khan, 2010), mental health (Clarke & Singh, 2004), positive emotions and performance (Skinner & Brewer, 2002).

Overall, these direct relationships emphasize the influences of stress and cognitive appraisal on nurses' mental health, confirming the negative consequences of stress on mental health and the differential relationships of different types of cognitive appraisal on nurses' well-being. These results are consistent with the Cognitive Appraisal Theory (Lazarus, 1999; Lazarus & Folkman, 1984).

Hypothesis 2 confirmed the importance of cognitive appraisal in the relationship between occupational stress and psychological health. The mediation model, in which the direct path between stress and psychological health problems was maintained, displayed the best fit indices of the three structural models (e.g., direct, partial, and full models) for both primary and secondary cognitive appraisals. This result confirmed the influence of cognitive appraisal in the relationship between occupational stress and psychological health; however, it also reinforced the specific influence of occupational stress on nurses' psychological health (the mediation model achieved better fit indices than the full model).

These results have some practical implications. They provide evidence that the processes of cognitive appraisal represent an underlying mechanism that should be considered to understand human adaptation to work settings. However, because of the positive relationship between stress and psychological health, it should also be reinforced that specific work conditions can impair professionals' well-being regardless of how they appraise the conditions and their professional activities. Thus, it is acceptable to assume that both individualized and organizational interventions designed to promote positive human functioning at work are useful. An individualized intervention can help workers (i.e., nurses) adopt more positive and functional patterns of cognitive appraisal via the promotion of more challenging and less threatening forms of job perception and via

training to increase their ability to cope with work stress and assume more control regarding the tasks to be accomplished. However, an intervention directed at the organization as a whole (i.e., health care systems) is also useful and can induce changes in the structures, cultures, and policies of work to ameliorate the specific consequences of occupational stress for individuals' health and well-being.

Overall, the test of the relationships between these three factors is useful in capturing the dynamic processes between occupational stress (antecedent variable), cognitive appraisal (mediating variable), and psychological health problems (consequent variable). As previously discussed, from a transactional perspective, the stress experience results from the interaction between an individual and a specific situation that is appraised as taxing or exceeding the individual's resources (Lazarus & Folkman, 1984). Thus, it becomes important to not only establish the sources and consequences of stress in high-risk activities (such as the activities performed by health professionals) but also understand how cognitive appraisal influences this relationship via the facilitation or debilitation of human adaptation to occupational settings. Few empirical findings on this relationship exist. The lack of such research is likely because this process is individualistic and dynamic and changes across the specific characteristics of the stress event, the individual involved, and the situation in which the event occurred. However, some empirical findings indicate the need to combine these factors to demonstrate the impact of cognitive appraisal on of health professionals' mental and physical well-being (Goh et al., 2010; Gomes et al., 2013; Kausar & Khan, 2010). By testing these relations, research can contribute to the fascinating study of the factors involved in human adaptation to work contexts.

In addition to the low return rate of the study (although the final sample is considerable) and the fact that participants worked in different workplaces (e.g., hospital

care and primary health care), a limitation of this study is the cross-sectional nature of the data collection, precluding the establishment of cause-effect influences. Thus, this study did not capture the dynamic changes between the stress context and the individual, which is an important point reinforced by the transactional perspective of human adaptation to changing contexts (Lazarus, 1999). However, the results obtained in this study confirm the importance of cognitive processes in the relationship between stress and psychological health in nurses, indicating that how these professionals view their jobs and react as individuals are underlying mechanisms. However, to overcome this problem, future research should utilize a longitudinal methodology that enables the observation of whether cognitive appraisal processes influence the relationship between stress and psychological consequences across different time periods and across different personal (e.g., age, sex) and professional (e.g., years of experience, work specialty) characteristics of health professionals. Nevertheless, this study emphasizes that researchers and managers should consider ways to mitigate the effects of occupational stress on employees. This mitigation can be accomplished through strategies directed at helping individuals appraise their work in a challenging way and manage sources of stress more effectively by establishing work systems that are human friendly to prevent many of the negative effects of stress on professionals, such as nurses.

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