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ORIGINAL ARTICLE

Investigation of occupational stress and coping strategies among civil engineering professionals in the Brazilian Amazon

Investigação do estresse ocupacional e das estratégias de enfrentamento entre profissionais da engenharia civil na Amazônia

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ABSTRACT Occupational stress represents a considerable risk for the health and well-being of a person. The main aim of this research is to identify the most frequently occurring stressors and predictors of occupational stress in Amazon civil engineers, as well as to highlight the coping strategies employed by them. A questionnaire and a semi-structured interview were used as methods. The results showed that stress agents that usually affect civil engineers are the pressure related to job responsibility, followed by work-family conflict, where women present higher stress levels than men. Regarding coping strategies, it has been noted that the practice of physical activity was considered a common approach for senior engineers, and that social support was frequently observed among the majority of the sample. Hopefully, this research will contribute to the study of occupational stress in relation to the construction industry, as well as assist organizations and professionals in applying effective stress-coping strategies.

KEYWORDS Occupational stress. Coping strategies. Engineering. Occupational health. Brazil.

RESUMO *O estresse ocupacional representa um risco considerável para a saúde e o bem-estar do indivíduo. O principal objetivo desta pesquisa é identificar os estressores e os preditores de estresse ocupacional mais frequentes em engenheiros civis da Amazônia Brasileira, assim como destacar as estratégias de enfrentamento utilizadas por eles. Um questionário e uma entrevista semiestruturada foram utilizados como métodos. Os resultados demonstraram que o agente estressor que geralmente afeta os engenheiros civis é a pressão relativa à responsabilidade do cargo, seguida pelo conflito trabalho-família, no qual as mulheres apresentam níveis de estresse mais elevados do que os homens. Quanto às estratégias de enfrentamento, se observou que a prática de atividade física foi majoritária em engenheiros nível sênior e que o apoio social foi comum à maioria da amostra. Espera-se que esta pesquisa contribua para a estrutura de estudos sobre estresse ocupacional relacionado à indústria da construção, bem como possa auxiliar as organizações e profissionais na aplicação de estratégias assertivas de enfrentamento do estresse.*

PALAVRAS-CHAVE *Estresse ocupacional. Estratégias de enfrentamento. Engenharia. Saúde ocupacional. Brasil.*

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Introduction

Important changes in labor practices have occurred in recent years, including employment security, characterized by continuity and stability, which has been replaced by more flexible relationships, such as fixed-term agreements. Furthermore, the competitive pressure among companies has increased. These changes have resulted in considerable work pressure in many professions[1], and consequently, there has been an increase in reported problems related to occupational stress.

Stress has been associated with negative consequences[2], such as the onset of physical and mental diseases. It has impacted employees' productivity, well-being, job satisfaction, and quality of life[3-5]. At the psychosocial level, stress can contribute to mental disorders, alcoholism, substance abuse[6], and suicide[7]. At the physical level, it is linked to high cholesterol, stomach diseases, increased systolic blood pressure, and the acceleration and progression of coronary disease[8-11]. Consequently, all the psychosocial risks in the work environment, including stress, have become a focus of international research[12].

Therefore, occupational stress is considered a global problem present across most sectors in various countries, including the construction industry[13]. In this context, civil engineers in the construction industry face high work pressure, insecure work environments[14,15], a lack of safety training[16], high rates of fatalities and work accidents[17], among other reasons. These characteristics make it possible to classify civil engineering as a high stress profession[18,19].

Research on the factors that predispose individuals to stress is significant, as there are few studies analyzing stress predictors in the construction industry workforce[20,21]. Additionally, there is limited research comparing the factors that cause occupational stress among workers in this sector[15].

Therefore, the aim of this research is to identify the main reasons and predictors of occupational stress among civil engineers in northern Brazil, specifically in the Amazon region. Furthermore, it seeks to analyze the coping strategies used by these professionals to improve their quality of life and well-being. This research will contribute to the theoretical framework of this topic, filling knowledge gaps related to coping strategies and stress in the construction industry. It will also assist companies and professionals in developing strategies to reduce occupational stress levels, helping to mitigate its consequences.

Occupational stress and coping strategies

By definition, occupational stress is the accumulation of physical and emotional harmful responses to health issues that occur when employees are presented with work demands that exceed their knowledge, skills, or challenge their ability to cope[22]. Hart and Cooper[23] consider occupational stress as a multifactorial integration. On one hand, there are personal and personality variables of the employee, and on the other hand, there are the work environmental and organizational characteristics. This integration results from the employee's evaluation of the work environment and the extent to which they can adapt to it[24]. It is concluded that working conditions influence the issue of stress. Exposure to stressful conditions in the work environment, also called occupational stressors, can strongly influence worker health. Being exposed to occupational stressors in the work environment can significantly affect the health of employees[22].

There are numerous occupational stressors and, according to the literature, the main ones are: work characteristics, organizational roles[25], interpersonal work relationships, career development, and organizational factors related to the work structure[26,27], work-family conflict[28], and pressure related to job responsibility[29]. The main characteristics of these stressors are described in *chart 1*.

Chart 1. The main characteristics of the occupational stressors

Occupational stressor	Main Characteristics
Work characteristics	It is related to work demands and control, that is, how the employee copes with demands that exceed his or her control or work capacity.
Organizational roles	It is divided into conflict and role ambiguity, and it is linked to the employee not having enough information about his or her real function in the work environment.
Interpersonal work relationships or Social Support	It is linked to the relationship between colleagues and supervisors in the workplace
Career development	It covers the beginning, maintenance, end-of-career, evolution conditions, impacts of under-promotion, over-promotion, status incongruence and career insecurity (which it is linked to the lack of work stability).
Factors related to Organizational structure and climate	It is related to lack of autonomy in decision making, restrictions on behaviors and policies inherent in employment.
Work-family conflict	It is associated with the incompatibility of work and family demands and occurs when the energy invested in one of these factors is excessive, causing negative impacts on the other factor.
Pressure related to job responsibility	Associated with the responsibility that the worker has for people and equipment in the work environment

Source: Prepared by the authors based on Cooper, Dewe and O'Driscoll[28] and Ferreira et al.[29].

In order to maintain homeostasis, the individual uses psychobiological resources to cope with stressful events and avoid the effects of stress[30-32]. This individual confrontation, both psychological and biological, against the stressors, is called coping[33].

Coping strategies, or coping, are efforts to reduce or stop threats, harm, and loss, or to reduce the suffering associated with stress[34]. Coping with stress emphasizes cognitive and behavioral processes[35]. Coping can be problem-focused and emotion-focused[36]. In the first approach, the person tries to solve the problem or act to change the source of stress, while in the second approach, they try to reduce or manage the emotional distress linked to the stressful situation[37].

Material and methods

The research method used was both quantitative and qualitative and followed two main steps: 1) the selection and application of research tools, namely an occupational stress questionnaire and a semi-structured interview; and 2) the analysis of data, relating the occupational stressors identified in the interview and the stress questionnaire with the characteristics of the civil engineers, together with their coping strategies.

Participants

The research was administered to a total of 202 civil engineers in the Amazon region of Brazil and included 72 women and 130 men. When asked about children, most of the engineers interviewed reported that they do not have children (52%). The sample was divided into the following categories: 1) Marital status: single, married, divorced, and in a common-law partnership; 2) Type of employment, categorized as public or private sector; 3) Specific roles, categorized as managerial engineers, construction engineers, designers, occupational safety engineers, teachers, and others. The category 'others' included engineers classified as inspectors, consultants, experts, budget analysts, analysts, and professionals who perform more than one role; 4) Years of experience, divided into three levels: junior, for engineers with up to 5 years of service; mid-level, for 6 to 10 years of service; and senior, for more than 10 years of experience. *Table 1* shows the detailed breakdown of the sample.

Table 1. Detailed breakdown of the sample of engineers

Marital Status	N	%	Specific roles	N	%
Single	104	51.5	Managing engineers	57	28.2
Married	83	41.1	Site engineers	34	16.8
Divorced	06	3.0	Designers	28	13.9
Common-law	04	2.0	Occupational safety engineers	19	9.4
People who didn't answer	05	2.5	Teachers	18	8.9
			Others	44	22.8
Type of employee	**N**	**%**	**Years of experience**	**N**	**%**
Public	56	27.7	Junior-level	82	40.6
Private	146	72.3	Mid-level	37	18.3
			Senior-level	83	41.1

Source: Prepared by the authors.

Search tools

For quantitative data collection, the scale developed in Brazil by Ferreira et al.[29], published under the title 'Evaluation of Psychosocial Stressors in the Labor Context Scale: Development and Psychometric Evidence', was used. This scale consists of 35 items and is answered on a six-point Likert-type scale ranging from 'it never affects me' to 'it always affects me'. It includes seven dimensions of stress: role conflict and ambiguity, role overload, lack of social support, career insecurity, lack of autonomy, work-family conflict, and pressure related to job responsibility. The scale's main theoretical model is based on the work of Cooper, Dewe, and O'Driscoll[28], adapted to the reality of workers in Brazil.

For qualitative data collection, a semi-structured interview was conducted centered around three main questions: 1) Do you consider yourself stressed? 2) What are the causes of stress in your daily work life? 3) What coping strategies do you use to combat such events? The first two questions were used specifically to obtain information about the specific stressors associated with the civil engineer's job. The third question sought to identify coping strategies used to address these stressors. These interviews were recorded using a voice recorder and transcribed for later analysis.

Data analysis

Initially, the adequacy of the stress scale for the sample of engineers was evaluated using the Cronbach coefficient, which showed acceptable values ranging from 0.70 to 0.95 across the different dimensions of stress. Subsequently, to analyze the data obtained, confirmatory factor analysis and the Shapiro-Wilk test were performed, with the significance level set at 5%.

Following this, exploratory data analysis and descriptive statistics were conducted, including the calculation of mean, frequency, percentage, standard deviation, standard error, and 95% confidence interval. Next, several variables were analyzed together using Student's t-test and ANOVA. Multiple linear regression analyses were also performed on the stress dimensions to

identify possible predictors and understand the influence these dimensions have on one another.

Ethical considerations

The general standards of academic ethics required by the Brazilian government were met, including obtaining approval from the research ethics committee to carry out this study[38]. Subsequently, authorization was obtained from the authors of the research tool for its use with the sample of civil engineers. During data collection, all engineers interviewed signed informed consent forms to participate in the interviews and share the data obtained. Research began only after all ethical requirements were met.

Results and discussion

Occupational stress analysis

In analyzing the semi-structured interview, participants were initially asked if they considered themselves to be stressed. Thus, 34.4% of the engineers answered YES and 65.6% answered NO. Of the participants who answered YES, 63.6% were senior engineers (more than 10 years of experience) and were mostly employees of private companies. The opposite occurred with junior-level engineers, where the highest percentage of NO answers was obtained (40.63%), meaning the majority of new professionals in the profession did not consider themselves stressed.

Table 2 shows the results of the analysis of the stress questionnaire, regarding the means and standard deviations/standard errors.

Table 2. Dimensions of occupational stress most prevalent in the sample (in order)

Stress Occupational Dimension	Mean	Standard deviation	Position as most stressful
Pressure related to job responsibility	4.30	1.44	1st
Work-Family Conflict	3.60	1.53	2nd
Role Conflict and Ambiguity	3.52	1.42	3rd
Lack of Autonomy	3.43	1.52	4th
Job Insecurity	3.08	1.45	5th
Lack of Social Support	3.00	1.22	6th
Role Overload	2.90	1.30	7th

Source: Prepared by the authors.

Note: In the average factor, 1 equals the minimum degree of stress and 6 equals the maximum degree of stress.

In general, the most prevalent stress dimension in the sample of civil engineers was the pressure r elated to job responsibility, in which statements related to errors in the profession that can harm coworkers and cause loss of equipment/products were factors that obtained the highest average and, consequently, had the greatest impact on the sample.

The causes for the prominence of this dimension can be diverse, and they were

observed through the answers obtained in the qualitative interview, with the following standing out: the pressure inherent to the job, arising from management, top management, or the excess of work and goals to be achieved; the interpersonal relationships, represented by the relationship engineer-client, engineer-worker, and engineer-government agency; and the delays in the work, which can be caused by lack of materials, rework, bureaucracy, among others.

This stress dimension was also observed by Pereira[39], who, when analyzing occupational stress in managers in Brazil, concluded that, when it comes to action planning, deadlines, workload, and demands for results, stress is generated. There is also evidence that when the schedule is adhered to, i.e., when there are no delays for various reasons, the professional experiences a sense of job satisfaction and reduced stress[40].

In second place comes work-family conflict, with not being able to disconnect from work when at home, taking work home, and not having time for personal life because of work being the factors that most affected the engineers. This is confirmed by the work of Bowen and Zhang[41], who, when analyzing work-family conflict among construction workers, concluded that it is directly associated with work pressure and that this usually occurs due to work activities that are taken home. Bowen et al.[42] ranked this conflict as the strongest stress predictor for the difficulty in balancing work demands and family responsibilities.

In third place comes role conflict and ambiguity, where situations such as receiving contradictory instructions about what to do at work and being asked to do things that go against one's own principles were the main causes that affected professionals in this dimension of stress. On this subject, based on the data collected in the interviews, the contradictions found in the relationship with the clients, in which they change their minds several times (as happens with architectural projects), causing changes in the way of working and/or rework, were a unanimous situation among the engineers that causes or predicts stress. These conflicts or contradictions of information are also found in the bureaucracies to regularize work. Burkert et al.[43] and Rizzo et al.[44] stated that in this situation professional find themselves unable to make decisions correctly since they do not have the necessary information and authority to act, thus causing stress.

The lack of autonomy follows as the fourth most stressful dimension, in which not being able to plan one's own working hours and being unable to decide when to be temporarily absent from the work environment were the stressors that obtained the highest average responses. This is followed by career insecurity, which is mainly linked to a possible job loss; lack of social support, which is associated with support from colleagues and superiors in the work environment and in personal problems; and role overload, which is related to overwork.

When the stressors were associated with the sociodemographic variables, it was concluded that women are often more stressed than men in their work environments. This was observed in the dimensions: conflict and role ambiguity ($t(202) = 1.985$; $p < .05$); lack of autonomy ($t(202) = 3.018$; $p < .05$), pressure related to job responsibility ($t(202) = 3.241$; $p < .05$) and work-family conflict ($t(202) = 2.880$; $p < .05$).

One possible reason why these stressors are more intense for women, as indicated by the results, is the predominance of the male gender in the industry, where women have to prove their technical ability and quality because they are minority[45-47]. Sunindijo and Kamardeen[48] analyzed the gender issue in the construction industry and found that women suffer from discrimination, bullying, and sexual harassment, highlighting symptoms of anxiety and acute stress, resulting in psychological health problems.

The higher frequency of the stressor work-family conflict in the female gender caused

consequences such as frustration and feelings of guilt when the professional was unable to reconcile multiple roles, i.e., her role as mother and/or wife at home and the demands required by the profession, in which the search for this balance generated emotional and/or physical wear. This conflict can be more intense depending on the type of employee, with workers from private companies usually being more affected by this stressor compared to civil servants[49].

Stress scores were also compared based on the respondents' specific function. *Table 3* shows this analysis.

Table 3. Analysis of the main roles of engineers with the stress dimensions

	Average on the stress dimension						
Specific function	**RCA**	**RO**	**LSS**	**CI**	**LA**	**WFC**	**PRJR**
Site engineer	4.03	2.98	2.74	3.13	3.75	3.93	4.46
Managing engineer	3.34	2.78	2.73	2.99	3.42	3.44	4.13
Designer	3.47	3.16	3.07	3.27	3.45	3.70	4.56
Occupational safety engineer	4.08	2.69	2.71	3.53	4.00	3.97	4.71
Teacher	3.32	3.19	2.73	3.32	3.41	3.80	4.25

Source: Prepared by the authors.

Key: RCA – Role Conflict and Ambiguity; RO – Role Overload; LSS – Lack of Social Support; CI – Career Insecurity; LA – Lack of Autonomy; WFC – Work-Family Conflict and PRJR – Pressure Related to Job Responsibility.

Table 3 particularly shows the dimensions that affect engineers according to their specific role, with a mean ranging from 1 to 6. In conflict and role ambiguity, safety engineers are the most affected ones, followed by site engineers. In the overload of roles, teacher and the designers are the most affected ones, and the lack of social support affects mainly the designer. Safety engineers are the most affected by career insecurity, lack of autonomy, work-family conflict, and pressure related to job responsibility, making it the position most susceptible to occupational stress.

The relationship between the stress dimensions and the number of children the respondents had was analyzed. The career insecurity dimension was significant when compared to the number of children, showing that those who have children are more stressed compared to individuals without children. Career insecurity affected both younger and older engineers working in the private sector, especially during the period in which the research was conducted, i.e., during the pandemic, because of job instability.

Finally, at this stage of the research, data related to productivity were obtained. Of the total, 53.2% of the respondents reported that stress or a stressful situation reduced their performance in the work environment, with reasons ranging from psychological to physical. On the psychological side, mental fatigue and demotivation were mentioned, while on the physical side, the aggravation of pre-existing diseases, such as hypertension, caused the engineer to leave the workplace. Similar results were found by Lazaridis et al.[50], showing that stress influences the duration of temporary incapacity for work related to arterial hypertension.

It is worth mentioning that the relationship between occupational stress and productivity has been the subject of investigations, as shown by Lepine et al.[51], Gilboa et al.[52], Maffia and Pereira[53], and Kamardeen and Sunindijo[47], who found reduced performance and the

impact of stress on productivity, the latter analyzing these factors in the construction industry.

Occupational stress predictors

The second question in the semi-structured interview aimed to understand what causes stress in the participant's daily work life. It sought to explore more specifically the situations that trigger stress. The answers were recorded, transcribed, and a word cloud was used to identify five major groups of stress predictors: deadlines, information incompatibility, manpower, and work pressure.

Deadlines indicate that the time factor—encompassing delays in construction materials, schedule delays, and short notice to meet goals—is the main predictor of stress in the profession. Information incompatibility is related to design contradictions and poorly run services due to a lack of communication. Manpower is linked to problems in providing engineering services, leading to reworks. Work pressure consists of demands from management, usually arising from the previous issues, such as delays in work, materials, rework, and more.

The connection between these stressors was also analyzed, with a focus on how one stressful event could influence another, as in some situations, one reinforces the other[54]. A single stressor was observed not typically trigger stress on its own; rather, a combination of several factors is necessary. The greater the intensity, frequency, and combination of these factors, the more likely stress is to develop[55].

As mentioned earlier, pressure related to job responsibility, work-family conflict, role ambiguity, and lack of autonomy were the dimensions of stress that most affected the sample of engineers. Based on this information, a general multiple linear regression model was applied to analyze these factors, as shown in *table 4*.

Table 4. Multiple linear regressions in order (most significant to least significant)

Dependent variable Independent variable	R	R^2 adjusted	Beta	T
Lack of Autonomy				
Conflict and role ambiguity	0.789	0.611	0.235	4.30
Career Insecurity			0.260	4.74
Work-Family Conflict				
Pressure related to the job responsibility	0.786	0.606	0.266	5.287
Lack of Autonomy			0.505	8.033
Pressure related to the job responsibility				
Work-Family Conflict	0.668	0.428	0.263	3.943
Conflict and role ambiguity			0.429	5.287
Career Insecurity				
Lack of Social Support	0.643	0.395	0.334	5.089
Conflict and role ambiguity				
Lack of Autonomy	0.633	0.382	0.374	4.304

Source: Prepared by the authors.

Table 4 shows that role conflict and ambiguity, along with career insecurity, account for 61.1% of the variance in lack of autonomy. It also reveals that pressure related to job responsibility and lack of autonomy account for 60.6% of the variance in work-family conflict.

Regarding the relationship between lack of autonomy and role conflict and ambiguity, studies indicate that role ambiguity affects the autonomy of professionals governed by hierarchy. For instance, Guimarães et al.[56] found this phenomenon among Portuguese judges. Belias et al.[57] also note that autonomy plays a moderating role in the relationship between role conflict and job satisfaction, reducing the consequences of role conflict and increasing job satisfaction. Additionally, Sun et al.[58] found a strong correlation between role conflict, ambiguity, and mental health problems among construction workers.

Colakoglu[59] indicated that career competencies are positively linked to autonomy and negatively linked to career insecurity. In other words, the greater the insecurity about remaining in a job, the less autonomy on has, as the professional's ability to make choices is impaired, which consequently hinders their competencies.

Ahuja et al.[60] and Ahuja et al.[61] studied stress in IT professionals and found results related to work-family conflict and lack of autonomy. They stated that when professionals do not have the autonomy to choose their workplace and are forced to be far from home during the week, the work-family conflict stressor is more prominent in their daily routine. That is, if they lack autonomy to decide where to work, it impacts their ability to balance work and family time. Michel et al.[62] also stated that lack of autonomy is a predictor of work-family conflict.

Table 4 also shows other predictions with the stressors that are negligible, where the independent variables account for less than 50% of the variance. This is the case with the dependent variable pressure related to job responsibility, career insecurity, and role conflict and ambiguity.

Coping analysis

The semi-structured interview was used to survey the stress coping actions through Question three, which asked which coping strategies were used by the engineer to combat stressful events, obtaining more than two coping strategies per interviewee. This question looked at the ways of coping with stress, i.e., problem-focused or emotion-focused coping[33]. The interviews showed that 65.6% of civil engineers focus on emotion, while 34.4% focus on the problem (cause of stress). To analyze this variable in relation to gender, the answers from men and women were isolated. Of all the men, 65% focus on emotion, and 35% focus on the problem. From this, it can be observed that most engineers, regardless of gender, tend to face problems with a focus on emotion.

In view of the diversity of answers, it was also possible to notice differences between senior engineers and junior-level engineers. For example, most senior engineers (65%) use physical exercises as a strategy to cope with stress, such as cycling, walking, swimming, and running, among others. The constant practice of exercise is already known in the literature as fundamental to combat stress[63–67]. While Cungi[68] corroborates this finding by classifying physical exercises as positive coping strategies, Valinote et al.[69] claim that those who practice physical activities have lower perceived work demands and consequently lower perceived stress.

However, junior-level engineers (76%) do not do the same, that is, they do not use physical exercises to combat stress. The method used is mainly technology to take the focus away from the problem, such as watching television shows, playing video games, watching movies, and listening to music. These factors are unusual when compared to senior-level engineers.

It was also possible to notice in the answers a coping strategy common to the entire sample, which is social support, referring to contact or

support from other people. Sixty-two percent of the engineers reported that they use it to cope with stress. This social support is multiple and can come from family, friends, and other professionals in the field. The role of social support is relevant because it directly influences an individual's well-being and good mental health[70]. This was verified by Paschoal et al.[71], Gottardo and Ferreira[72], and Hirschle and Gondim[73], who stated that social support mitigates the impact of stress and increases the sense of well-being, and consequently, makes professionals more satisfied in the work environment.

In the case of the civil engineers, this support network was instrumental in reducing stress, as it allowed the engineers to share the burden of the stressor, improving their well-being at work. The research of Mutkins et al.[74] and Nunes and Souza[75] corroborates this result and provides information that stress has a negative relationship with social support. That is, the higher the perceived social support, the lower the stress level of the professional.

Conclusions

The research identified that the stressors that affect civil engineers the most are the pressure related to job responsibility, followed by work-family conflict. However, it is possible that work-family conflict has lost its impact in the analysis because the majority of the sample was composed of professionals with single marital status and no children. Also, the female gender showed a higher frequency of stress.

When related to coping strategies, it was found that engineers, in general, use social support/support to combat stress. Thus, these results contribute to the theoretical framework of the subject and can help several engineering professionals in the future, as well as work organizations that seek to reduce stress levels in the workplace. As future work, we suggest the application of the concepts observed in this research, verifying its impact on the workers' health and on the company's financial scope, because stress reduction can mean more productivity and well-being in the profession, reducing the aggravation of physical and psychological diseases.

Collaborators

Nery LMC (0000-0001-9695-8755)* contributed to the conception of the work, data collection, analysis and interpretation, writing and approval of the manuscript. Maués LMF (0000-0002-1762-8617)* contributed to the conception of the work, critical review and analysis of the final version of the manuscript. Moreira FS (0000-0002-7169-0534)* and Heineck LFM (0000-0001-7275-4184)* also contributed to the conception of the work and critical review of the manuscript. ■

References

1. Siegrist J, Li J. Associations of extrinsic and intrinsic components of work stress with health: A systematic review of evidence on the effort-reward imbalance model. Int J Environ Res Public Health. 2016;13(4):432. DOI: https://doi.org/10.3390/ijerph13040432

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2. Avellaneda MA, Kamenetzky G. Regulation of the stress response by social buffering: A review across species. Interam J Psychol. 2021;55(1):e1439. DOI: https://doi.org/10.30849/ripijp.v55i1.1439

3. Almeida H, Brito-Costa S, Alberty A, et al. Modelos de stress ocupacional: sistematização, análise e descrição. Int J Educ Psychol. 2016;2(1):435-454.

4. Griffin MA, Clarke S. Stress and well-being at work. In: Zedeck S, editor. APA handbook of industrial and organizational psychology, Vol 3: Maintaining, expanding, and contracting the organization. Washington, DC, US: American Psychological Association; 2011. p. 359-397. DOI: https://psycnet.apa.org/doi/10.1037/12171-000

5. Lima GKM, Gomes LMX, Barbosa TLA. Qualidade de Vida no Trabalho e nível de estresse dos profissionais da atenção primária. Saúde debate. 2020;44(126):774-789. DOI: https://doi.org/10.1590/0103-1104202012614

6. Levine S, Scotch N. Social Stress. New York: Taylor & Francis; 2017.

7. Vieira B, Bandini M, Azevedo V, et al. Risco de suicídio no trabalho: revisão integrativa sobre fatores psicossociais. Saúde debate. 2023;47(136):253-268. DOI: https://doi.org/10.1590/0103-11042022313617

8. Choi KS, Kang SK. Occupational psychiatric disorders in Korea. J Korean Med Sci. 2010;25(supl):S87-93. DOI: https://doi.org/10.3346/jkms.2010.25.s.s87

9. Fletcher BC. Work, stress, disease, and life expectancy. New York: Wiley; 1991.

10. Jeon SW, Kim YK. Application of assessment tools to examine mental health in workplaces: Job stress and depression. Psychiatry Investig. 2018;15(6):553-560. DOI: https://doi.org/10.30773/pi.2016.10.24

11. Wang HX, Leineweber C, Kirkeeide R, et al. Psychosocial stress and atherosclerosis: family and work stress accelerate progression of coronary disease in women. The Stockholm Female Coronary Angiography Study. J Intern Med. 2007;261(3):245-254. DOI: https://doi.org/10.1111/j.1365-2796.2006.01759.x

12. Pucci SM, Kanan LA, Silva BF. Riscos psicossociais no contexto do trabalho. Rev GepesVida. 2017;3(6):141-153.

13. International Labour Organization. Workplace Stress: a Collective Challenge. Turin: ILO; 2016.

14. Irumba R. Spatial analysis of construction accidents in Kampala, Uganda. Saf Sci. 2014;64:109-120. DOI: https://doi.org/10.1016/j.ssci.2013.11.024

15. Leung MY, Liang Q, Olomolaiye P. Impact of Job Stressors and Stress on the Safety Behavior and Accidents of Construction Workers. J Manag Eng. 2016;32(1):40150191-401501910. DOI: https://doi.org/10.1061/(ASCE)ME.1943-5479.0000373

16. Zou PXW, Zhang G. Comparative study on the perception of construction safety risks in China and Australia. J Constr Eng Manag. 2009;135(7):620-627. DOI: https://doi.org/10.1061/(ASCE)CO.1943-7862.0000019

17. Cambraia FB, Santos TWS, Lantelme EMV. Disseminação de práticas de segurança e saúde do trabalho entre empresas de construção por meio de ambientes colaborativos de aprendizagem. Ambient Constr. 2017;17(4):425-439. DOI: https://doi.org/10.1590/s1678-86212017000400205

18. Enshassi A, Al.Swaity E. Key stressors leading to construction professionals' Stress in the Gaza Strip, Palestine. J Constr Dev Ctries. 2015;20(2):53-79.

19. Ling FYY, Goh X. Managing stressors faced by cost engineers. J Prof Issues Eng Educ Pract. 2017;144:(2). DOI: https://doi.org/10.1061/(ASCE)EI.1943-5541.0000354

20. Chan APC, Nwaogu JM, Naslund JA. Mental ill-health risk factors in the construction industry: Systematic review. J Constr Eng Manag. 2020;146(3):04020004. DOI: https://doi.org/10.1061/(asce)co.1943-7862.0001771

21. Langdon RR, Sawang S. Construction workers' well-being: What leads to depression, anxiety, and stress? J Constr Eng Manag. 2018;144:1-15. DOI: https://doi.org/10.1061/(ASCE)CO.1943-7862.0001406

22. Jick TD, Payne R. Stress at work. J Organ Behav. 1980;5(3):50-56. DOI: https://doi.org/10.1177/105256298000500315

23. Hart PM, Cooper CL. Occupational stress: Toward a more integrated framework. In: Handbook of industrial, work and organizational psychology. Washington, DC: Sage publications; 2002. p. 93-114.

24. Adriaenssens J, Hamelink A, Bogaert P Van. Predictors of occupational stress and well-being in First--Line Nurse Managers: A cross-sectional survey study. Int J Nurs Stud. 2017;73:85-92. DOI: https://doi.org/10.1016/j.ijnurstu.2017.05.007

25. Yuan Z, Li Y, Tetrick LE. Job hindrances, job resources, and safety performance: The mediating role of job engagement. Appl Ergon. 2015;51:163-171. DOI: https://doi.org/10.1016/j.apergo.2015.04.021

26. Sampson JM, DeArmond S, Chen PY. Role of safety stressors and social support on safety performance. Saf Sci. 2014;64:137-145. DOI: https://doi.org/10.1016/j.ssci.2013.11.025

27. Wang D, Wang X, Xia N. How safety-related stress affects workers' safety behavior: The moderating role of psychological capital. Saf Sci. 2018;103:247-259. DOI: https://doi.org/10.1016/j.ssci.2017.11.020

28. Cooper CL, Dewe PJ, O' Driscoll MP. Organizational stress: A review and critique of theory, research, and aplications. Thousand Oaks, CA, EUA: Sage publications; 2001. Epub ahead of print 2001. DOI: https://doi.org/10.1093/bjsw/32.5.648

29. Ferreira MC, Milfont TL, Silva APC, et al. Escala para avaliação de estressores psicossociais no contexto laboral: construção e evidências de validade. Psicol Reflex Crit. 2015;28(2):340-349. DOI: https://doi.org/10.1590/1678-7153.201528214

30. Davies KJA. Adaptive homeostasis. Mol Aspects Med. 2016;49:1-7. DOI: https://doi.org/10.1016/j.mam.2016.04.007

31. Godoy LD, Rossignoli MT, Delfino-Pereira P, et al. A comprehensive overview on stress neurobiology: Basic concepts and clinical implications. Front Behav Neurosci. 2018:12:127. DOI: https://doi.org/10.3389/fnbeh.2018.00127

32. Lipp MEN. Transtorno de Adaptação. Bol Acad Paul Psicol. 2007;1:72-82.

33. Lazarus RS, Folkman S. Stress, appraisal, and coping. New York: Springer Publishing Company; 1984.

34. Carver CS, Connor-Smith J. Personality and coping. Annu Rev Psychol. 2010;61:679-704. DOI: https://doi.org/10.1146/annurev.psych.093008.100352

35. Barros MS, Wilhelm FA. Estratégias de enfrentamento do estresse utilizadas por jovens universitários no extremo norte do país. Rev Bras de Iniciação Científica. 2020;7:100-117.

36. Gomes AR, Afonso JMP. Occupational stress and coping among Portuguese Military Police Officers. Av Psicol Latinoam. 2016;34:47-65. DOI: http://doi.org/10.12804/apl34.1.2016.04

37. Folkman S. The case for positive emotions in the stress process. Anxiety Stress Coping. 2008;21(1):3-14. DOI: https://doi.org/10.1080/10615800701740457

38. Ministério da Saúde (BR); Conselho Nacional de Saúde. Resolução nº 466, de 12 dezembro de 2012. Aprova as diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Diário Oficial da União, Brasília, DF. 2013 jun 13; Edição 112; Seção I:59-62.

39. Pereira LZ. Novas perspectivas para a abordagem do estresse ocupacional em gerentes [tese]. Belo Horizonte. Universidade Federal de Minas Gerais; 2005.

40. Ling FYY, Loo CMC. Characteristics of jobs and jobholders that affect job satisfaction and work performance of Project Managers. J Manag Engineering. 2015;31:401439-1-401439-10. DOI: http://dx.doi.org/10.1061/(ASCE)ME.1943-5479.0000247

41. Bowen P, Zhang RP. Cross-boundary contact, work-family conflict, antecedents, and consequences: Testing an integrated model for construction professionals. J Constr Eng Manag. 2020;146:04020005. DOI: https://doi.org/10.1061/(ASCE)CO.1943-7862.0001784

42. Bowen P, Edwards P, Lingard H, et al. Predictive Modeling of Workplace Stress among Construction Professionals. J Constr Eng Manag. Epub ahead of print 2014. DOI: https://doi.org/10.1061/(asce)co.1943-7862.0000806

43. Burkert M, Fischer FM, Schäffer U. Application of the controllability principle and managerial performance: The role of role perceptions. JMAR. 2011;22:143-159. DOI: https://doi.org/10.1016/j.mar.2011.03.002

44. Rizzo JR, House RJ, Lirtzman SI. Role conflict and ambiguity in complex organizations. Adm Sci Q. 1970;15:150-163. DOI: https://doi.org/10.2307/2391486

45. Lombardi MR. Engenheira e gerente: desafios enfrentados por mulheres em posições de comando na área tecnológica. Rev Tecnol Soc. 2006;2(3):63-86. DOI: http://dx.doi.org/10.3895/rts.v2n3.2485

46. Strobino MRC, Teixeira RM. Empreendedorismo feminino e o conflito trabalho-família: estudo de multicasos no comércio de material de construção da cidade de Curitiba. Rev Adm (São Paulo). 2014;49(1):59-76. DOI: https://doi.org/10.5700/rausp1131

47. Kamardeen I, Sunindijo RY. Personal Characteristics Moderate Work Stress in Construction Professionals. J Constr Eng Manag. 2017;143(10). DOI: https://doi.org/10.1061/(ASCE)CO.1943-7862.0001386

48. Sunindijo RY, Kamardeen I. Work stress is a threat to gender diversity in the construction industry. J Constr Eng Manag. 2017;143(10):04017073. DOI: https://doi.org/10.1061/(ASCE)CO.1943-7862.0001387

49. Francis V, Lingard H, Prosser A, et al. Work-family and construction: Public and private sector differences. J Manag Eng. 2013;29(4):392-399. DOI: https://doi.org/10.1061/(ASCE)ME.1943-5479.0000154

51. LePine JA, Podsakoff NP, LePine MA. A meta-analytic test of the challenge Stressor-hindrance stressor framework: An explanation for inconsistent relationships among Stressors and performance. Acad Manage J. 2005;48(5):764-775.

52. Gilboa S, Shirom A, Fried Y, et al. A meta-analysis of work demand stressors and job performance: Examining main and moderating effects. Pers Psychol. 2008;61(2):227-271. DOI: https://psycnet.apa.org/doi/10.1111/j.1744-6570.2008.00113.x

53. Maffia LN, Pereira LZ. Estresse no trabalho: estudo com gestores públicos do Estado de Minas Gerais. Rev Eletrôn Adm (Porto Alegre). 2014;20(3):658-680. DOI: https://doi.org/10.1590/1413-2311.0052014.47163

54. Veloso HM, Pimenta SM. Análise do estresse ocupacional na realidade bancária: um estudo de caso. Rev Adm FEAD. 2005;2:111-128.

55. Santos OA. Ninguém morre de trabalhar: o mito do stress. 3. ed. São Paulo: Texto novo; 1995.

56. Guimarães TA, Gomes AO, Correia PMAR, et al. Conflitos e ambiguidades de papéis no trabalho de juízes: As percepções de juízes portugueses. Rev Adm Pública. 2017;51(6):927-946. DOI: https://doi.org/10.1590/0034-7612156373

57. Belias D, Koustelios A, Sdrolias L, et al. Job satisfaction, role conflict and autonomy of employees in the Greek Banking Organization. Procedia Soc Behav Sci. 2015;175:324-333. DOI: https://doi.org/10.1016/j.sbspro.2015.01.1207

58. Sun C, Hon CKH, Way KA, et al. The relationship between psychosocial hazards and mental health in the construction industry: A meta-analysis. Saf Sci. 2022;145:105485. DOI: https://doi.org/10.1016/j.ssci.2021.105485

59. Colakoglu SN. The impact of career boundarylessness on subjective career success: The role of career competencies, career autonomy, and career insecurity. J Vocat Behav 2011;79(1):47-59. DOI: https://doi.org/10.1016/j.jvb.2010.09.011

60. Ahuja M, Chudoba KM, George JF, et al. Overworked and isolated? Predicting the effect of work-family conflict, autonomy, and workload on organizational commitment and turnover of virtual workers. Proceedings of the Annual Hawaii International Conference on System Sciences IEEE. 2002;3586-3593. DOI: http://dx.doi.org/10.1109/HICSS.2002.994454

61. Ahuja MK, Chudoba KM, Kacmar CJ, et al. Its road warriors: Balancing work-family conflict, job autonomy, and work overload to mitigate turnover intentions. MIS Q. 2007;31:1-17. DOI : https://doi.org/10.2307/25148778

62. Michel JS, Kotrba LM, Mitchelson JK, et al. Antecedents of work–family conflict: A meta-analytic review. J Organ Behav. 2010;32(5):689-725. DOI: https://psycnet.apa.org/doi/10.1002/job.695

63. Burton JP, Hoobler JM, Scheuer ML. Supervisor workplace stress and abusive supervision: The buffering effect of exercise. J Bus Psychol 2012;27(3):271-279. DOI: https://psycnet.apa.org/doi/10.1007/s10869-011-9255-0

64. Correa GA, Leão MAG. A prática do esporte como estratégia de enfrentamento do estresse docente. Reeduc. 2020;17(49):336-354.

65. Long BC, Flood KR. Coping with work stress : psychological benefits of exercise. Work Stress. 1993;7(2):109-119. DOI: https://psycnet.apa.org/doi/10.1080/02678379308257055

66. Replogle RA. It's time to eliminate work stress. Mobility Forum. 2017;25(4):38.

67. Tamayo A. Prioridades axiológicas, atividade física e estresse ocupacional. Rev Adm Contemp. 2001;5(3):127-147. DOI: https://doi.org/10.1590/S1415-65552001000300007

68. Cungi C. Saber administrar o estresse na vida e no trabalho. 2. ed. São Paulo: Larousse do Brasil; 2006.

69. Valinote HC, Pacheco LF, Viana FP, et al. Análise da qualidade de vida, capacidade para o trabalho e nível de estresse em trabalhadores da construção civil. Rev Bras Ciênc Ambient. 2015;(32):115-126.

70. Love PED, Edwards DJ, Irani Z. Work stress, support, and mental health in construction. J Constr Eng Manag. 2010;136(6):650-658. DOI: https://doi.org/10.1061/(ASCE)CO.1943-7862.0000165

71. Paschoal T, Torres CV, Porto JB. Felicidade no trabalho: relações com suporte organizacional e suporte social. Rev Adm Contemp. 2010;14(6):1054-1072. DOI: https://doi.org/10.1590/S1415-65552010000700005

72. Gottardo LFS, Ferreira MC. Suporte social, avaliações autorreferentes e bem-estar de profissionais de saúde. Arq Bras Psicol. 2015;67(1):146-160.

73. Hirschle ALT, Gondim SMG. Stress and well-being at work: A literature review. Ciênc saúde coletiva. 2020;25(7):2721-2736. DOI: https://doi.org/10.1590/1413-81232020257.27902017

74. Mutkins E, Brown RF, Thorsteinsson EB. Stress, depression, workplace and social supports and burnout in intellectual disability support staff. J Intellect Disabil Res. 2011;55(5):500-510. DOI: https://doi.org/10.1111/j.1365-2788.2011.01406.x

75. Nunes WS, Souza FP. Níveis de estresse e apoio social em servidores públicos de serviços socioassistenciais de alta complexidade. Aletheia. 2017;50(1):95-110.

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