

## Professional Chronic Stress - Clinical, Physiological and Biological Evaluation

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Submitted : 17 Jan 2022 ; Published : 2 Feb 2022

**Citation:** Doscan, A. M., & Spiru, L. Professional Chronic Stress - Clinical, Physiological, and Biological Evaluation. J Medical Case Repo, 2022; 4(1): 1-4.

**Abstract**

**Introduction:** Since stress is an element increasingly present in our professional lives, there is now a greater interest in understanding the role of stress and the response to stress in human brain aging.

**Materials and methods:** The case of 38 years old woman is reported, who works in the financial field (bank) and has a declarative high level of professional stress. Clinical, functional, and biological evaluations of chronic stress were made, to identify and subjectively evaluate stressors, as well as for objective quantification of their impact on the body and evaluation of the effect of specialized interventions aiming to improve the quality of personal life and increase professional efficiency.

**Discussion and Conclusions:** Subjective evaluation questionnaires as well as objective measurements of biological and physiological parameters can be considered useful tools for evaluating chronic stress, especially when used together. Early identification of occupational stressors, clinical and biological knowledge of stress as well as the development of preventive and personalized measures, may define a future approach in the context of preventing stress-induced pathologies, like depression and anxiety, but also neurocognitive disorders (from mild cognitive impairment to early Alzheimer's disease).

**Keywords:** chronic stress, occupational stressors, brain aging, stress-induced pathologies.

**Introduction**

Professional chronic stress is, in nowadays modern society, an important risk factor for the physical and mental health of a young worker. It can lead to diseases such as depression, anxiety, cardiovascular diseases, and, last but not least, to early brain aging - early onset of a cognitive disorder such as Alzheimer's disease.

So, because stress is an element more and more present in our professional lives, there is now a greater interest in understanding the role of stress and the response to stress in human brain aging. The key role of the hippocampus and its related brain structures in recognition as well as in controlling stress response feedback is recognized today. (Miller & O'Callaghan, 2005). Also, this can be partially explained by biochemical pathways. Epel (2009) A lot of published studies showed the link between depression and chronic stress identifying elevated stress hormones, mainly cortisol and catecholamines (Chrousos & Gold, 1992), (Melamed et al., 1999), (Steptoe, et al., 2000). It seems that about 40% of depression is characterized by high cortisol levels, but

also, both depression and chronic stress have been linked to hypocortisolemia or low Corticotropin-Releasing Hormone (CRH) (Fries et al., 2005), (Gold & Chrousos, 2002).

By reviewing the literature one can notice that stress is associated with psychological disturbances, as well as physiological changes, such as lowered heart rate variability (HRV) (Van Amelsvoort et al., 2000). Cardiovascular diseases can appear if prolonged chronic stress exists. (Chandola et al 2010), (Kivimäki et al 2012). HRV analysis has also been proposed as a suitable non-invasive method to study the effects of work-related stresses on cardiovascular autonomic regulation during work and sleep (Chandola et al 2010), (Schaufeli et al., 2020), (Miller & O'Callaghan, 2005). Employees exposed to high job strain or work stress have indicated a shift in autonomic cardiac balance towards sympathetic dominance during both working hours and sleep (Van Amelsvoort et al., 2000), (Vrijkotte et al., 2000), (Schaufeli et al., 2020). In a study conducted by Rustko, H. et. al., significant correlations were found between cortisol after awakening and indicators of stress and relaxation

during sleep. These results suggest that stress and relaxation states can be determined from HR and HRV indexes (Schaufeli et al., 2020).

In our study, the case of 38 years old woman is reported, who works in the financial field (bank) and has a declarative high level of professional stress. Clinical, functional, and biological evaluations of chronic stress were performed to identify and subjectively evaluate stressors. Also, these evaluations were performed to objectively quantify their impact on the body and assess the effect of specialized interventions aiming to improve the quality of personal life and increase professional efficiency.

## Materials and Methods

A 38 years old female reported high levels of chronic professional stress and complained that she felt exhausted. She also experienced a depressive mood for several months. The initial interview with the patient aimed to identify the factors with major stressor potential in her history from childhood to the present. In our case, the history of the patient was marked by emotional traumas induced by the tensions in her family during childhood, represented by high demands and lack of recognition of her merits by the father.

Less happy couple experiences, both in the remote past and more recently, are also important stressors. Moreover, the subject stated that her current profession is not vocational, and she would have rather gone for another direction in her development; still, the satisfaction she experiences can be the result of a process of maturation, of acceptance of the situation, but it does not necessarily mean the fulfillment of inner call. Surgery with general anesthesia and other conditions that have repeatedly affected her general health is also mentioned.

After the interview, three questionnaires were conducted, represented by stress evaluation and quantification scales: 1. Symptoms of stress - subjective assessment (adapted and translated from The Copenhagen Burnout Inventory) (Kristensen et al., 2005), (Copenhagen Burnout Inventory n.d.). 2. Stress-amplifying thoughts and attitudes and 3. Daily stressors (adapted and translated from Burnout Assessment Tool -BAT) (Schaufeli et al., 2020), (Oprea et al., 2021). These questionnaires consist of a subjective self-evaluation of the existing stress symptoms, attitudes, and thoughts regarding stress factors and the presence of daily stressors and their nature, personal or work-related.

Self-assessment suggests a relatively important level of exhaustion in both the work-related and personal life spheres; less in terms of relationship / working with customers.

Ranking the daily stressors mentioned reconfirmed the factors identified in the interview on her history - mainly aspects of personal development, health, financial security, and inter-human relationship.

The subjective factors of stressors enhancement reveal mainly a state of anxiety, a tendency towards self-overload, and

perfectionism, resulting from the desire to avoid conflicts and to win and maintain the trust of others; these elements also suggest a possible problem of self-confidence.

For the biological assessment of stress (i.e., professional stress in our case) the patient was instructed to self-collect saliva and urine samples for testing the stress hormones' levels: urinary testing of serotonin, melatonin, adrenalin /noradrenaline and dopamine, and salivary cortisol. We handed over to the subject special recipients (salivary sample tubes) to self-collect saliva for salivary cortisol levels - 3 tests at 08:00 AM, 2:00 PM, and 08.00 PM. It has been shown that morning cortisol levels can be a reliable biological marker for an individual's adrenocortical activity when measured repeatedly, with strict reference to waking time. Pruessner et al., (1997) We also gave her a special container and instructed her to self-collect urine samples for urinary determination of serotonin, melatonin, adrenalin /noradrenaline, and dopamine levels. For our patient the results of biological samples were as follows:

### Salivary cortisol levels profile:

- **Morning cortisol level:** 8:00 A.M. is higher than the normal range (51 nmol/l, reference range 18 - 30 nmol/l).
- **Cortisol level at noon:** 2.00 P.M is also higher than the normal range (21 nmol/l, reference range 12-18nmol/l).
- **Evening cortisol level:** 8.00 P.M is in the normal range (7.7 nmol/l, reference range 7 - 10nmol/l).

Overall cortisol level is also much higher than normal range-303 h\*nmol/l reference range 147 - 228 h\*nmol/l).

This cortisol profile (excluding the possibility of an exogenous cortisol intake) indicates a hypercortisolism type reaction, indicating the existence of a state of chronic stress.

### The measurement of urine neurotransmitters

Serotonin was at the lower limit of normal values (80 µg/g Creatinine - reference range 80 - 400 µg/g Creatinine), suggesting a possible anxiety-depressant disorder.

Urinary catecholamines, especially adrenaline, were low, indicating a diminished ability to an acute stress reaction, and possible development of a state of exhaustion (adrenaline in urine/creatinine 1µg/g creatinine - reference range < 25; noradrenaline in urine/creatinine 23 µg/g creatinine - reference range < 115).

Dopamine was in the normal range (dopamine in urine/creatinine 229 µg/g creatinine, reference range < 450).

For the physiological assessment of professional stress, we monitored the heart rate variability. Heart rate variability (HRV) is the conventional method adopted to describe fluctuations in RR intervals modulated by the autonomous nervous system at the sinus node. Martinmäki et al., (2006) To do that, we used Firstbeat Bodyguard 2 (Firstbeat Technologies Ltd, Jyväskylä, Finland), a beat-to-beat heart rate monitoring device that is targeted for long-term monitoring of heart rate variability (HRV). Physical activity was used to capture 72 hours of data (Parak & Korhonen, 2015), (FIRSTBEAT n.d.). This device is small, portable, and has a main part and two electrodes to be placed on the subject skin. The Firstbeat Bodyguard 2

and disposable electrodes were placed on a subject's body according to the instructions in the user manual. The skin was cleaned using alcohol before the placing of the electrodes. The disposable electrodes and cables were fastened with medical tape to decrease the level of possible motion artifacts. Teisala et al., (2014) Our patient's HRV (Heart rate variability) results and interpretation consist of a comprehensive report – Lifestyle Assessment (Fig.1). We present it below:

**Range evaluated - 4 days:** two working days (Friday and Monday) and two weekend days (Saturday and Sunday). On the first working day (Friday) there were no recovery time intervals during working hours, and on the other assessed working day (Monday) the recovery intervals were installed only towards the end of the day.

The balance between stress and recovery was negative on both working days, due to the lack of recovery during working hours and the recovery installed late during sleep. Both weekend days had a positive balance, the best recovery being recorded during Saturday when the subject was provided with a relaxing activity (massage); Sunday's positive effect was mainly due to good sleep. The physical activity was low, not reaching the recommended level to have health benefits; moreover, the body's passage over the weekend was perceived by the body as a stress activator - this reaction can be explained in the chronic stress state.

## Discussion

The history of our patient shows a series of factors with major stressor potential: a traumatic emotional childhood added to growing up, other unpleasant experiences in her intimate relationships and professional life, indicate that there are enough elements to justify the installation of a state of chronic stress. These elements are also confirmed by the subjective evaluation questionnaires, as well as by the objective measurements of the biological and physiological parameters.

Increased levels of morning cortisol reveal “the preparation for the battle” with daily professional challenges, while the end of the day barely normal levels indicate a possible exhaustion trend and lack of recovery, obvious during working time. It was, however, encouraging to notice that choosing the right type of relaxing activities and sleeping enough during free time provides a good recovery of resources.

The elements related to the subject's history, corroborated with the biological and physiological markers, indicate the existence of a state of chronic stress. The factors from the remote history suggest the existence of an anxiety-depressive disorder, most likely not evaluated and not addressed properly, with a significant impact on the current emotional balance and the ability to react and adapt to daily stressors.

## Management and Recommendations

In-depth evaluation, by the specialist, of the possible anxiety-depressive disorder - this is an essential element in the correct management of professional and personal stress.

It is especially helpful to reconsider the impact of a psychogenic stressor (old and/or recent) - to determine the necessary measures to restore psychological coping skills, appropriate to everyday challenges, and maintain long-term emotional balance.

The installation of a degree of exhaustion at the end of the day, in conjunction with the lack of recovery, underscores the importance of inserting relaxing breaks during working hours. Establishing a set of objectives regarding lifestyle changes in what the working time, free time, and sleep are concerned, should improve emotional and physical health. We recommend special attention to the actions meant to increase self-esteem and self-confidence, to the possibilities of relaxation during the day, and the preparations before going to bed.

## Conclusion

Subjective evaluation questionnaires as well as objective measurements of biological and physiological parameters can be considered useful tools for evaluating chronic stress, especially when used together.

Early identification of occupational stressors, clinical and biological knowledge of stress as well as the development of preventive and personalized measures, may define a future approach in the context of preventing stress-induced pathologies like depression and anxiety, but also neurocognitive disorders (from mild cognitive impairment to early Alzheimer's disease).

## Conflicts of Interest

None declared.

## Financial Support

None declared.

## Informed Consent Statement

Informed consent was obtained from all subjects involved in the study. Written informed consent from the patient to publish this paper was obtained.

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