



Association of Occupational Stress for Health Care Professionals and Incidence of COVID-19. Is there an Increased Risk?

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The objective of the present review is to investigate if there could be a correlation and/or association of occupational stress of health care workers (HCWs) leading to an increase in the risk and/or incidence of COVID-19 due to many reasons including suppression of immunity function.

Correlation between stress, CNS and immunity

The central nervous system, endocrine system, and immune system are complicated combination of systems correlated and interacted with one another, and thus, disturbing the sensitive interactivity among these systems might dysregulate the immune response due to triggering of stressful life events and generation of negative emotions [1]. It is important to know that what is known by an allostatic load is mainly caused by a stressor which is an external stimulus or an event that exceeds an individual's perceived ability to withstand and tolerate either emotionally or physically [2].

It is well known that two main pathways for stress-signaling contribute to immune deregulation, namely, the autonomic nervous system and hypothalamic pituitary adrenal (HPA) axis, meanwhile, on experiencing a stressful situation as perceived by the brain, an activation of the HPA axis and the sympathetic-adrenal medullary axis (SAM) occurs causing release of specific hormones including; cortisol, adrenocorticotropic hormone (ACTH), prolactin, growth hormone, norepinephrine, and epinephrine that modulate the immune function and therefore affects personnel immunity level [1].

On the other hand, immunity is known to be either natural or acquired resistance of an organism to bacterial or viral invaders, diseases, or infections with adequate tolerance to avoid allergy and autoimmune diseases. Lymphocytes, including T, T-helper and B cells, are the main type of cells of the immunity system [3], where, T-helper cells produce cytokines that direct and amplify the rest of the immune response and antibodies produced by B cells which binds to free virus to prevent its entry into cells, neutralizing bacterial toxins, and opsonization, in which a coat of antibody increases the effectiveness of natural immunity [4].

What about stress and its enormous effect on the body? Chronic stress can suppress or dysregulate innate and adaptive immune responses by altering cytokine balance, thereby inducing low-grade inflammation and suppressing the function of immune-protective cells [5]. Job strain model postulates that job stress becomes highest when job demands are high and job control is low, moreover, it was demonstrated that job strain predicts coronary heart disease, stroke, type 2 diabetes, musculoskeletal pain, depression, and Poor psychological state [6]. These might be extended to infectious diseases including viral and bacterial infections.

In general, exposure to psychosocial job stress (high job demands, low job control, high effort–reward imbalance, over commitment) had a measurable impact on immune parameters (i.e. Reduced NK cell activity, NK and T cell subsets, CD4+/CD8+ ratio, and increased inflammatory markers) [6].

Occupational stress

Stress is an experience and its consequences of a situation of a person who is unable to tolerate physically or psychologically with the challenge, in addition, employees and workers in different fields are facing on daily basics different types of workspace stress. Being a lawyer, policeman, soldier, rail way driver, pharmacist, physician and academic professor all of the previously mentioned carriers are facing a specific and different types of workspace stress during work time depending on the details, challenges and requirements of each job [7].

Concerning health care professionals who are performing a great and important role in providing health services for public, they are facing different types of challenges and different levels of risks including; infection due to biological specimen/secretions contact and psychological burden, as well as, failure of saving life of a critical medical condition and inability to meet expectations.

Association of occupational stress in health care systems, immunity system and incidence of COVID 19

Many biological functions in the human body follow a circadian rhythm [8]. Professional occupations that require an involvement in night shifts require persons to work and sleep at times that conflict with the rhythm leading to a circadian rhythm disruption and disturbed sleep, which have been proposed as possible sources of associated shift work health problems [9,10]. At present, shift work has linked to an increased risk of metabolic, cardiovascular, and infectious diseases [11,12].

It was believed that shift work might affect the immune system and subsequently correlated with cardiovascular disease and infection [13-15]. Studies have indicated that adaptive and innate immune system display circadian rhythms, moreover, disruption of these immune responses might enhance infection susceptibility [14-16], besides, it was reported that a higher incidence and severity of respiratory tract infections were abundant in shift workers compared with non-shift workers [11,17].

Fatigue levels due to acute stress resulted from sleep deprivation during night shifts and chronic stress due to persistent perturbations in work/sleep schedules negatively impact the health status of health care worker. In addition to, sleep deprivation may result in an increase in T cell populations which might have a detri-

mental effects since it has been suggested that some cytokines such as IL-6 can reactivate latent herpes virus [18].

Personal protective equipment (PPE) is an important factor affecting susceptibility of health care workers (HCWs) for infection with a disease. It was found in a prospective study of 2,135,190 individuals that frontline HCWs may have up to a 12-fold increased risk of reporting a positive COVID-19 test. Also, compared with those who reported adequate availability of PPE, frontline HCWs with inadequate PPE had a 31% increase in risk of infection [19].

In general, patient exposure contributes for the probability of infection spreading among HCWs especially when there is a lack in PPE. Health care workers in hospitals who are taking care of COVID-19 confirmed or suspected patients are more likely to be exposed to high risk of infection and negative psychological stress than the general population, where, they are concerned about being infected and spreading the virus to family, friends or colleagues [20], and they may also face moral dilemmas in decision making around provision of care with limited resources [21].

Disaster management and medical emergency staff (Pre-hospital) which are responsible for providing health services to patients in emergency units and, if necessary, transporting them to medical centers are playing a crucial role in protection of individuals' health. This profession is also one of the most stressful jobs for some reasons including: time pressure, patients' critical situation, patient's companion expectations, open workplace, fear of incompetency in saving dying patients, decision-making in critical situations [22].

It is worthy to mention that, Health Care Workers (HCWs) are at risk of emotional strain and physical exhaustion from the provision of care to growing numbers of patients who may then rapidly deteriorate; they may be exposed to critical illness or death of their co-workers [23].

Psychological survey results published in The Lancet Psychiatry proposed that the rates of depression, anxiety, insomnia and stress symptoms among medical staffs involved in COVID-19 epidemic prevention and control were as high as 50.7%, 44.7%, 36.1% and 73.4% respectively [24]. The previously reported percentages for HCW might be an evidence that stress and psychological disorders might be without a doubt an important cause of increasing the incidence of medical staff infection including viral infection as COVID-19.

There are increasing reports of health care workers that are exposed to shunning and harassment by a scared public because of their occupation. A Parliament member in Singapore called the attention to what he called 'disgraceful actions' against medical staffs raising from fear and panic. Some examples of behavior described were: Taxi drivers reluctant to pick up staff in medical uniform, a healthcare professional's private-hire vehicle canceled because she was going to a hospital, a nurse in a lift asked why she was not taking the stairs and that she was spreading infections to others by taking the lift [25]. All these actions would, definitely, spread a depressed and disappointed surrounding HCWs and enriched them with unappreciated actions and attitudes towards their noble services being frontline defense of an epidemic mysterious disease as COVID-19.

In a study performed on all medical residents from different specialties in Shiraz University of Medical Sciences, 311 out of 350 questionnaires were completed by residents (response rate = 88.8%) the questionnaire results showed an average score of residents' total stress of 156.35 out of 250 which was considered high [26].

A Work-related stress assessment for a registered nurses employed in emergency department showed that significantly more females than males were in a situation of strain (18.5% vs 9.8% $p < 0.05$). In females, low social support was correlated with high levels of job stress (18,5% vs 4,4% $p < 0.05$) [27].

Increased Risk of COVID-19 among Health Care Workers (HCWs):

A previous global analysis of three high risk and three low risk countries suggested that the overall incidence of COVID-19 infection in HCWs is higher than that of the general population. The HCWs' risk confined in an analysis included nurses and physicians was 9 to 11 folds higher than the general population, regardless of country/region risk status, although the absolute risk of documented infection remained quite low (under 3% even in high risk countries e.g. Italy, China, Spain) [28].

It was found that 7.0% greater absolute risk (95% confidence interval for risk difference 4.7%-9.3%) of SARS-CoV-2 among HCWs compared to non-HCWs in a university hospital setting in New Jersey, where, the highest infection rate was recorded in the nurses (11.1%), on the other hand, the ICU workers had lower in-

fection rate (2.1%) compared to those on other units (4.9-9.7%) [29] which might be attributed to precision of execution of process control precautions and PPE use which protect HCWs in ICU compared to other departments.

In a case series from Wuhan hospital, for 138 patients treated from COVID-19, it was found that 40 patients (29%) were from the medical staff of whom 31 (77.5%) worked on general wards, 7 (17.5%) in the emergency department, and 2 (5%) in the intensive care unit (ICU) [25].

Up to date there were no reliable data on hospitalization and mortality risks for HCWs, where, most available data were from media reports. Within the high-risk countries, these limited data suggested that case fatality risk was substantially lower in health-care providers than in the general population in Italy (0.01% vs. 13.9%) and Hubei (1.2% vs. 4.8%) due to increased testing within HCWs identifying a larger group of less severely ill cases [28].

Management of health care workers occupational stress

It was reported in a randomized controlled trials including interventions for reducing psychological stress in medical staff showed that physical relaxation as massage was more effective in reducing stress compared to non- intervention. Besides, mental relaxation including meditation for a period of six months decreases stress. Organizational interventions includes; changes in working conditions, organizing support, changing care, increasing communication skills and changing work schedules were used to reduce stress on workers. In the end, modifications in work schedules from continuous work to a weekend breaks and from a four-week work schedule to a two-week schedule helps to reduce stress [30].

A multi-faceted self-care strategy should properly be phased to support the sense of control and contribution of medical staff without making them feel irrationally responsible for the lives of patients. For instance, during work shifts, medical staff should engage in these behaviors: self-monitoring and pacing, regular check-ins with colleagues, family, and friends, partnership or teamwork, brief relaxation, and stress management breaks, continuous peer consultation and supervision, time-outs for essential body care and refreshment [31].

At the same time, healthcare providers should avoid the following: long time work without checking in with colleagues, feeling

that they are performing ineffectively, excessive intake of caffeine drinks and sweets, engaging in self-talk and attitudinal obstacles to self-care which increases stress [31].

Herein a stepwise plan for stress management including; cooperation between different co-workers, different ways to connect virtually with friends and family in breaks at work, such as social media, phone as meaningful interactions with beloved ones are essential to human well-being [32].

In conclusion, occupational stress can result in suppression or dysregulation of immune function. Factors contributing to increase stress are fatigue, an acute stress resulting from sleep deprivation during night shifts, chronic stress due to persistent perturbations in work/sleep schedules, lack of personal protective equipment, patient exposure, negative psychological stress, critical situation decisions, social stigma and abuse due to public fears of infection.

Moreover, the increased risk of COVID-19 infection among HCWs in comparison with general population with decreasing mortality which might be related to an increase screening within HCWs and early management of a non-severe illness cases. Management of HCWs stress may include; highly appreciation from the general population, mental relaxation, stretch-release relaxation, yoga stretch for couple of minutes, light music during work' breaks may give some sort of stress release, exposure to natural elements and sunlight for certain minutes during work time may lead to decreasing stress.

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