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Analysis of Association Between Work Organization and Risk of Professional Burnout During COVID19 Pandemic: Cross-Sectional Study Among HCWs in Intensive Care Unit

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Abstract

Introduction: during COVID19, the Algerian health system was put under great strain. Despite its vulnerability, it adapted to the particular circumstances of this pandemic thanks to a profound modification of the organization of work. HCWs whose job is already known to cause anxiety are found exposed to the risk of professional burnout. Purpose: Assessment of the impact of the COVID 19 pandemic on the mental health of HCWs. Material and Method: cross-sectional study implemented in a COVID19 Intensive Care Unit (ICU). Burnout score is measured by the Copenhagen Burnout Inventory (CBI). Its statistical association is analyzed with professional, organizational factors and the resources made available. Two-sided tests were used, a significance threshold $p \leq 0.05$; descriptive univariate and bivariate analysis (Pearson's Chi2 test) to test the association between the Burnout score and its dimensions with the other variables. Results: population of 78 HCWs; sex ratio = 0.30; psychometric properties of CBI (α Cronbach = 0.88); Burnout: 94.3% including 17% in serious form. Doctors 16.7%, nurses 14.3%. Burnout is

associated with no professional or organizational factors (only with the notion of being affected by COVID19 (OR: 19; 95% CI [1.78 – 203.2] p 0.01). Satisfaction is high in relationships with colleagues (77%); with superiors (64%), low with resources made available (14%). Intention to quit job found in 23% cases. Conclusion: the burnout of HCWs in this ICU is not related to organizational factors, they are already exhausted by the pandemic: poor prognosis, high mortality rate, lack of radical solution to the problem.

Keywords

Burnout, Intensive Care Unit, Covid19 pandemic, Occupational mental health; Algeria.

1. Introduction

The COVID19 pandemic surprised the world with its rapid and exponential evolution and the most robust health systems found themselves on the verge of collapse. Healthcare personnel were on the front line of the fight against this pandemic but with practically no resources: absence of scientific information on the disease, development of dangerous misinformation regarding the disease, its treatment and then vaccination, terrible lack of personal protective equipment (PPE) and provision of equipment unsuitable for the risk.

Profound changes have concerned the organization of work in hospitals, all services of which have suspended their activities to devote themselves entirely to the care of patients in respiratory and vital distress. Thus, HCWs were moved away from their usual workplaces; subjected to drastic aseptic constraints, they suffers social and family isolation. This profound, rapid and unexpected upheaval added to the fear of being contaminated or of contaminating others, probably has consequences on their state of mental health and their psychological balance. Professional burnout is the most feared consequence; to prevent it, it must be assessed and its risk factors identified to avoid its serious complications as depression and leaving out work in healthcare jobs

1.1 Objectives

This study aimed to: 1) assess the prevalence of burnout; 2) its sub-dimensions and its serious form and 3) analyze its association with individual, professional and organizational factors. 4) Evaluate job satisfaction through 3 dimensions (satisfaction with colleagues, superiors and the resources made available) and the intention to leave out work. Our hypothesis is that the prevalence of professional burnout is high, particularly in its serious forms, that there is a strong association of burnout with organizational factors and that satisfaction is low with a strong intention to leave out work in the healthcare job.

2. Literature Review

It was evident that a significant alteration in the mental health status of caregivers in face of the COVID19 pandemic was occurring. On December 31, 2019, WHO learned of cases of "non-fatal viral pneumonia" in Wuhan in the People's Republic of China, and on March 18, 2020, it issued guidance related to mental health and psychological support of the COVID-19 outbreak (WHO, 2020). These guidelines, in the form of messages, are intended for the general population but also for health personnel. For the latter, these are 10 messages, 4 of which are intended for caregivers and 6 for heads of departments and managers of healthcare establishments. The common goal of these guidelines is to "promote social and psychosocial well-being. (WHO, 2020). The majority of studies were published in 2022 but were carried out at the end or during the first wave of the pandemic.

Probably the very first study was published in March 2020 and carried out in the People's Republic of China (Lai J, 2020). In Algeria, the first study published in 2021 was carried out from January 11 to March 9, 2021. All studies used a cross-sectional descriptive and analytical method by self-questionnaire. The questionnaires were distributed online and some via social networks. The sizes of the populations studied ranged from a few hundred (Aljabri D, 2022); (Acar Sevinc S, 2022); (Burns KEA, 2022), (Kapasa RL, 2021) to more than two thousand (Khasne RW, 2020); (Duarte I, 2020). The prevalence of burnout and its sub-dimensions was determined by the MCB. Other dimensions have been added to the classic inventories (MBI and CBI) such as depression and anxiety.

Khasne RW (Khasne RW, 2020) found in an evaluation of mental health status and prevalence of burnout among Indian healthcare workers involved in patient care COVID-19 (population : N= 2026 healthcare workers) personal burnout = 44.6% (903), Occupational burnout = 26.9% (544); More than half of respondents (1,069, 52.8%)

suffered from pandemic-related burnout. Younger respondents (21-30 years) had higher personal and professional burnout. The prevalence of personal and professional burnout was significantly ($p < 0.01$) higher among women. Physicians were 1.64 times more likely and support staff was 5 times more likely to experience pandemic-related burnout.

The results of a survey carried out in Portugal (Duarte I, 2020) among 2008 respondents from the Portuguese healthcare system are in favor of High levels of personal burnout : 1055 (52.5%) and High burnout in 1066 (53.1%). Reported health problems cited by 524 (26.1%) HCWs : 158 (30.2%) had a chronic respiratory illness, and 119 (22.7%) had a weakened immune system. Gender, parental status, marital status and salary reduction were found to be significant factors in personal burnout. Health problems and direct contact with infected people were significantly associated with greater susceptibility to high personal and professional burnout. Front-line jobs were associated with all three dimensions of burnout.

Another questionnaire based survey with a large population size (N= 1751) was conducted by Youssef in Lebanon (Youssef D, 2022) who used a Snowball sampling technique to assess the prevalence of burnout among healthcare workers in the context of COVID-19 and to identify its associated factors. He found that out of 1751 respondents from HCWs: Emotional Burnout : moderate and high aspects in 86.3%; Professional Burnout : moderate and high levels in 79.2%; Moderate and high levels of Relational Burnout in 83.3% workers. A Small percentage ($\leq 20\%$) in experienced. Female, married, doctors had poor health and specific living conditions: high levels of emotional burnout. Front-line work, a history of COVID-19 infection, or having a colleague who was infected with COVID-19, long working hours were found to be positively associated with high Emotional and Professional Burnout. Factors related to health status and living conditions, as for Emotional Burnout, age (> 30 years) and altruism were negatively associated with high Emotional Burnout. Front-line work, long working hours and high threat perception were positively associated with high Relational Burnout.

In Iran, Hajebi et al (Hajebi A, 2022) found slightly lower prevalence: N= 1,133 participants, Moderate and high burnout :554 (48.9%); women : 381 (50.5%); men : 173 (45.8%). A higher rate of burnout in women than in men was statistically significant ($p = 0.001$). The mean burnout score among individuals was 61.1 in participants with any mental disorder and 37.7 in participants without any mental disorder. Significant association was found between presence of anxiety, depression and burnout ($p < 0.0001$).

In studies where the number of caregivers is less than 1000, we find the survey conducted by Kunno J et al (Kunno J, 2024) in Thailand who found General burnout was present among medical staff at rate of 25.9%. The highest prevalence of burnout was among medical staff (25.9%). Higher prevalence of burnout among medical staff in all three CBI dimensions: personal, work-related and client-related (29.4%, 26.2% and 34.3%, respectively). The study showed that medical staff and women were significantly likely to suffer burnout (p -value 0.068). Regarding Burnout score, the majority of medical staff (8.54 ± 5.05) and women showed a significant burnout score ($p < 0.001$). HCWs without children (8.400 ± 5.14) had significant burnout score ($p < 0.001$). Less than 10 years' work experience had significant burnout score ($p < 0.001$).

Burns K. E. A et al (Burns KEA, 2022) in a multicenter cross-sectional North American survey, found among a population of 431 doctors working in objective intensive care units: 144 doctors (34.4%) reported feeling burnt out at work "once a week" or more and 237 doctors (56.6%) reported feeling burnt out "a few times a month" or more. With a percentage of (259 [63.8%]), burnout scores (3.6 ± 2.0) were moderate with 227 physicians (54.6%). Most doctors felt physically (297 [71.6%]) and emotionally (266 [63.8%]) exhausted at work. Compared to the pre-pandemic period, most physicians reported that their ability to adapt remained the same (231 [55.9%]) or decreased (102 [24.7%]) during the pandemic.

In Saudi Arabia Kingdom, Aljabri D et al (Aljabri D, 2022), using CBI and its subscales in an exhaustive survey of the front-line HCW's reports : A total of 207 responses received; the average Personal burnout score was 67.23%, the average Professional burnout score was 61.38% and the average Patient-related burnout score was 54.55%. Significant associations were found with women who worked more than 55 hours per week and whose work schedules and hours had been altered during the pandemic, had higher levels of personal and work-related burnout. Patient-related burnout was higher among nurses, people with fewer years of experience, and who were infected with COVID-19 and quarantined. Age was not a significant factor in burnout in any of the CBI subscales.

In Turkey, Acar-Sevinc S et al (Acar Sevinc S, 2022) used a Maslach Burnout Inventory (MBI) and the Beck Anxiety Inventory (BAI) to assess levels of anxiety and burnout among attending physicians, residents and ICU nurses. Of the residents, 97.1% reported having undergone COVID-19 testing, which was significantly higher than the rate of test exposure among attending physicians (42.3%, $p = 0.004$) and nurses (67.4%, $p = 0.001$). Although not reported in any of the attending physicians, COVID-19 was diagnosed in 20% of the residents and 2.3% of the nurses ($p = 0.003$); ($p = 0.015$ and 0.01 , respectively). DP score = 9 (8.2 to 10.7) HCWs a history of COVID-19 VS 6 (3 to 9) in those without a history of COVID-19 ($p = 0.037$).

In the countries of Maghreb, Kapasa R.L et al, (Kapasa RL, 2021) using the French version of MBI (MBI-HSS) among a population of 135 HCWs, found: Majority (84.44%) were in a burnout situation. The statistical factors significant for the 3 dimensions of burnout were: number of shifts per month, number of hours worked per week, number of hours worked per day, occupation time, satisfaction with the professional relationship with superiors and fear of being contaminated by Covid19. In Algeria, Kandouci Ch et al, (Kandouci C, 2021) used an online self-assessment of HCWs mental health and found that out of 1005 respondents the prevalence of Anxiety and Depression were 23.8% and 44.6% respectively. Healthcare professionals with a high resilience score were those who were in front-line with COVID-19 and those who feared contracting the disease.

This literature review shows that the prevalence of burnout among HCWs ranges from 25% to 85%. This great variability is conditioned by the size of the population, the geographical region, the specialty of the caregivers and their position on the front line or not. Burnout with a high score is often significantly associated with female gender, the profession of physician and the organization of work (long working hours per week, front-line of covid19). However, it is little or not significantly associated with individual factors such as age, seniority, poor health and specific living conditions.

3. Methods

A descriptive and analytical cross-sectional study is conducted in an university hospital center among healthcare workers of an Intensive Care Unit caring only patients with severe forms of COVID19. The survey is exhaustive including all doctors and nurses. Two-tailed tests and a significance threshold defined at 5% (Statistical significance was assessed using a p -value ≤ 0.05). An initial descriptive uni-variate analysis was performed to assess respondent characteristics. Bivariate analysis was conducted using Pearson's Chi2 test to test the association between the burnout score and its sub-dimensions with the other variables.

Previous research in the same field of interest was searched in scientific engines (Pub Med, Google scholar), as well as in scientific research specialized in occupational medicine:

- Articles from “the journal médecine du travail” published on the website of the Algerian Society of Occupational Medicine "samtalgerie.com".
- Doctoral theses in occupational medicine, whether or not published on the website of “Portail National de Signalement des Thèses” (<https://www.pnst.cerist.dz/>) and the website of Algerian Society of Occupational Medicine "samtalgerie.com". The search was carried out in French and English using key words: Burnout - nursing staff – COVID19, Healthcare Workers - intensive care unit – CBI.

Questionnaire

The collection medium is a questionnaire consisting of four parts

Part 1: socio-demographic and professional characteristics: age, gender, number of dependents (family size), history of: somatic, psychiatric (depression), burnout, position, grade, length of time in hospital, involvement in activities other than hospital care, such as teaching.

Part 2: Organizational characteristics during the pandemic COVID19: ICU working hours, whether working hours are increased, work rhythm, daily working hours, weekly working hours, number of shifts per week, per month, number of hours of each shift, weekend work, number of beds in charge.

Part 3: indicators of well-being at work: satisfaction with the resources provided, satisfaction with salary, satisfaction with relations with colleagues and superiors, satisfaction with the availability of PPE, competence in patient care and management, fear of being infected by colleagues, fear of infecting family member, Intention to leave work, History of COVID19 infection, number of times, loss of a family member to COVID19.

Part 4: The Copenhagen Burnout Inventory (CBI), questionnaire contains 19 items and measures 3 sub-dimensions: personal burnout (6 items), professional burnout (7 items), relational burnout (6 items). Each item is rated by the participant on a 5-point Likert scale ("almost never", "rarely", "sometimes", "often", "always"). Each response is coded into a numerical value (0, 25, 50, 75, 100). Exhaustion is noted if the total score is 50. A level of exhaustion below 50 indicates low or no exhaustion, while a score above 50 indicates moderate (50-75) and high (75-100) exhaustion.

Calculation of the CBI sub-dimensions: personal or emotional exhaustion (EE) - professional or work-related exhaustion (PE) – relational or patient-related exhaustion (RE): if score is below 50, there is no exhaustion or it's low, while a score 50 to 75 indicates moderate. Score above 75 indicates high exhaustion

4. Data Collection

The study is conducted outside a COVID19 wave from October 12 to December 21, 2022 which correspond to the phase between 3rd and 4th COVID19 wave. Data is collected using an individual, anonymous survey form distributed then collected by the investigator. Data entry and statistical analysis were carried out using Microsoft Office Excel 2013 software.

Ethical considerations: The information collected was accessible only to those involved in the study. All HCWs had given their consent before being included in the study.

5. Results and Discussion

Description of the population

The number of responses to the questionnaire was 71 out of 78 (91%), one form was excluded because it was incomplete, representing a response rate of 89.7%. The population is predominantly female (54 women and 16 men), sex ratio = 0.3. There are 42 doctors (60%) compared to 28 nurses (40%). The average age is 32 ± 7 years. Women are younger than men (30.6 ± 6.2 years vs 37 ± 9.1 years). In this population 18.6% have chronic illnesses, men more than women (37.6% vs 13%). More than half of them take care of other people ranging from one person up to 9 among them 50% take care of people with special needs whose number can reach 4.

Professionally, they are relatively young in the profession (seniority 6 ± 5 years). They work on average 9.8 ± 3.1 hours/day, 41.1 ± 3.9 hours/week and provide on-call duty on average 2.5 ± 1.1 per week and 8 ± 3.7 per month. Only 5 HCWs (7.1%) do not work on weekends. they take care of up to 30 beds per caregiver (average 9.8 ± 5.7 beds/HCW). Twenty-five HCWs (35.7%) carry out professional activities other than care; this most often involves teaching in the field of care and medicine. See Table 1

In terms of well-being at work, the vast majority of HCWs are not satisfied with their salaries and the resources made available to them (respective satisfaction rates 7.1% and 1.4%), otherwise they are satisfied with their relationships with colleagues (77.1%) and their superiors (64.3%). Only half of them recognize their skills in care. Finally, just over half (52.9%) are satisfied with personal protective equipment (PPE). Almost all (82.9%) of HCWs were affected by COVID19, including 8 cases (13.8%) of severe form. The fear of being contaminated or of contaminating a family member is reported by 87.1% and 97.1% respectively. The loss of a member of family was reported in 22.9% of cases. Finally, almost 2/3 (65.7%) intend to leave their job. There is no significant difference between women and men with regard to the above-mentioned factors except for the factor of age, chronic illnesses and the number of shifts per week. See Table 2.

Burnout and its under-dimensions

Burnout is present in almost all HCWs (66 out of 70; 94.3%). Crossed with socio-demographic, professional and organizational variables, a significant difference is noted with only seniority of less than 3 years versus equal or more to 3 years; the exercise or not of a professional activity other than care and whether or not affected by COVID19.

The analysis of the sub-dimensions of burnout reveals the same frequency of emotional (personal) exhaustion and professional exhaustion with 53 cases (75.7%) and a relatively low frequency of relational exhaustion of 31.4% (22 cases). See Table 3.

Crossed with personal, professional and organizational factors, these sub-dimensions are significantly linked to a few variables: emotional exhaustion with the satisfaction of colleagues and the impact by COVID19, professional burnout with the attack by COVID19 and the exercise of an activity other than healthcare. on the other hand, relational exhaustion is not linked to any variable. See Table 3.

The prevalence of the serious form of Burnout and its sub-dimensions, emotional, professional and relational exhaustion is estimated at 12.9%; 27.1%, 45.7% and 7.1% respectively. Burnout is significantly linked to the number of shifts per week; emotional exhaustion from satisfying relationships with superiors and losing a loved one to COVID19; professional burnout with the satisfaction of relationships with superiors and the exercise of an activity other than that of care. The severe form of relational exhaustion is not linked to any factor. See Table 4.

Discussion:

The results of this study are alarming. Almost all HCWs show signs of general exhaustion. Apart from relational exhaustion, which is relatively low, the two other dimensions mark the suffering of ¾ of HCWs on an emotional and professional level. But beyond this very high prevalence, the absence of a significant link with the majority of socio-demographic, professional and organizational factors deserves analysis and reflection. This statistical observation points towards the existence of a cause unrelated to the work situation. Two interpretations of this phenomenon are possible: the investigation took place between the 3rd and 4th wave of the pandemic, that is to say at the end of the particularly deadly wave (Delta serotype of SARS Cov2) and the oxygen crisis, a stage which deeply tested the nursing staff. The HCWs are no longer receptive to the conditions in which their work is carried out but they are exhausted by the horrors they have experienced. The second explanation, although unlikely, is that the HCWs in this unit are imbued with the culture of Burnout described among intensive care. They are often questioned about burnout by researchers from different fields of sociology, psychology, occupational medicine, etc. Professionals, find themselves experiencing the phenomenon without being able to attribute a cause linked to the conditions of exercise of their profession.

Table 1. Socio-demographic, professional and organizational characteristics

Gender	Population N = 70 Sex-ratio= 0.3	Male 16 (22.9%)	Female 54 (77.1%)	S
Age	32 ans ± 7 years Min : 23 – Max : 55	37 ± 9.1 years Min : 25 – Max : 52	30.6 ± 6.2 years Min : 23 – Max : 55	S
Dependents	1.6 ± 2 None : 36 Min : 1 – Max 9	2.7 ± 2.6 None : 6 Min : 1 - max 9	1.5 ± 0.6 None : 30 Min 1 – Max : 6	NS
Caring for people with special needs	18 Min : 1 – Max : 4	06 Min : 1 - Max : 4	12 Min : 1 - Max : 2	NS
Somatic history	13 18.6%	6 37.5%	7 13%	S
Diseases since the start of COVID19	22 31.4%	4 25%	18 33.3%	NS
Job	Doctors: 42 (60%) Nurses: 28 (40%)	10 06	32 22	NS
Seniority	6 ± 5 years Min:1 – Max: 25	9.2 ± 6.8 years Min : 3 – Max : 25	5.0 ± 4.2 years Min : 1 – Max 25	NS
Other activities	25 35.7%	7 43.7%	18 33.3%	NS
Working hours/day	9.8 ± 3.1 h Min : 6 – Max: 16	10.6 ± 3.9 h Min : 6 – Max : 16	9.6 ± 2.9 h Min : 6 - max : 16	NS
Working hours/week	41.1 ± 3.9 h Min : 34 - Max : 45	41.2 ± 1.1 h Min : 34 – Max 45	41.1±3.8 h Min : 34 – Max: 45	NS
Hours / shift	14.8 ± 3.2 h Min : 10 - Max : 24	14.9 ± 2.1 Min : 10 – Max : 16	14.8 ± 3.5 Min : 10 – Max : 24	NS

shift / week	2.5 ± 1.1 Min : 1 - Max : 4	2 ± 1.1 Min : 1 – Max : 4	2.6 ± 1.1 Min : 1 – Max : 4	S
shift / month	8 ± 3.7 Min : 1 - Max : 16	6.6 ± 4 Min : 1 – Max : 16	8.4 ± 4.8 Min : 2 – Max : 16	NS
Respect for week-end	5 7.1%	0	5 9.2%	NS
Number of beds supported	9.8 ± 5.7 Min : 2 - Max : 30	13.3 ± 7.1 Min : 3 – Max : 30	8.8 ± 4.9 Min 2 – Max 20	NS

S = significant p-value ; NS = Non-Significant p-value

Table 2. Prevalence of well-being factors in the population of HWCs

FACTORS	General Population	Male	Female	p-value sig < 0.05
Salary Satisfaction	5 7.1%	0 0%	5 9.3%	NS
Resources Satisfaction	1 1.4%	0 0%	1 1.8%	NS
Relation Colleague satisfaction	54 77.1%	13 81.3%	41 76%	NS
Relation superior Satisfaction	45 64.3%	12 75%	33 61.1%	NS
Satisfied with PPE	55 78.6%	14 87.5%	41 76%	NS
Satisfied with his care skills	37 52.9%	10 62.5%	27 48.2%	NS
Affected by COVID19	58 82.9%	13 81.3%	45 83.3%	NS
Severe form of COVID19	8 11.4%	2 12.5%	6 11.1%	NS
Fear of being infected	61 87.1%	13 81.3%	48 88/9%	NS
Fear for contaminating family	68 97.1%	15 93.8%	53 98.1%	NS
Loss of family member	16 22.9%	3 18.8%	13 24.1%	NS
Intention to leave work	46 65.7%	13 81.3%	33 61.1%	NS

S = significant p-value ; NS = Non-Significant p-value

Table 3. p-value and the relation quality between Burnout and its under-dimensions with socio-demographics, professional and organizational factors

Factors	General Population N = 70	Burnout	EE	PE	RE
		66 94.3%	53 75.7%	53 75.7%	22 31.4%
Genre	M/F	NS	NS	NS	NS

Age	<40/≥40 ans	NS	NS	NS	NS
job	Doctor /nurse	NS	NS	NS	NS
Somatic history	Yes /No	NS	NS	NS	NS
Dependents	Yes /No	NS	NS	NS	NS
Caring for people with special needs	Yes /No	NS	NS	NS	NS
Seniority	< 3 years/≥3years	S	NS	NS	NS
Other activities	Oui / Non	S	NS	S	NS
Working hours/day	≤ 8H / >8H	NS	NS	NS	NS
Working hours/week	≤ 40H / >40H	NS	NS	NS	NS
Shift / month	≤ 6 / >6H	NS	NS	NS	NS
Respect for week-end	Yes /No	NS	NS	NS	NS
Salary Satisfaction	Yes /No	NS	NS	NS	NS
Resources Satisfaction	Yes /No	NS	NS	NS	NS
Relation Colleague satisfaction	Yes /No	NS	S	NS	NS
Relation superior Satisfaction	Yes /No	NS	NS	NS	NS
Satisfied with PPE	Yes /No	NS	NS	NS	NS
Satisfied with his care skills	Yes /No	NS	NS	NS	NS
Affected by COVID19	Yes /No	S	S	S	NS
Severe form of COVID19	Yes /No	NS	NS	NS	NS
Fear of being infected	Yes /No	NS	NS	NS	NS
Fear for contaminating family	Yes /No	NS	NS	NS	NS
Loss of family member	Yes /No	NS	NS	NS	NS
Intention to leave work	Yes /No	NS	NS	NS	NS

S = significant p-value - NS = Non-Significant p-value - EE: emotional exhaustion – PE: professional or work-related exhaustion – RE: relational or patient-related exhaustion.

Table 4. p-value and the relation quality between the severe form of Burnout and its under-dimensions with socio-demographics, professional and organizational factors

Factors	General Population N = 70	Burnout	EE	PE	RE
		Severe form	Sever form	Sever form	Sever form
		9 12.9%	19 27.1%	32 45.7%	5 7.1%
Genre	M/F	NS	NS	NS	NS
Age	<40/≥40 ans	NS	NS	NS	NS
job	Doctor /nurse	NS	NS	NS	NS
Somatic history	Yes /No	NS	NS	NS	NS
Dependents	Yes /No	NS	NS	NS	NS
Caring for people with special needs	Yes /No	NS	NS	NS	NS
Seniority	< 3 years/≥3years	NS	NS	NS	NS
Other activities	Oui / Non	NS	NS	S	NS
Working hours/day	≤ 8H / >8H	NS	NS	NS	NS
Working hours/week	≤ 40H / >40H	S	NS	NS	NS
Shift / month	≤ 6 / >6H	NS	NS	NS	NS
Respect for week-end	Yes /No	NS	NS	NS	NS
Salary Satisfaction	Yes /No	NS	NS	NS	NS
Resources Satisfaction	Yes /No	NS	NS	NS	NS
Relation Colleague satisfaction	Yes /No	NS	NS	NS	NS

Relation superior Satisfaction	Yes /No	NS	S	S	NS
Satisfied with PPE	Yes /No	NS	NS	NS	NS
Satisfied with his care skills	Yes /No	NS	NS	NS	NS
Affected by COVID19	Yes /No	NS	NS	NS	NS
Severe form of COVID19	Yes /No	NS	NS	NS	NS
Fear of being infected	Yes /No	NS	NS	NS	NS
Fear for contaminating family	Yes /No	NS	NS	NS	NS
Loss of family member	Yes /No	NS	S	NS	NS
Intention to leave work	Yes /No	NS	NS	NS	NS

S = significant p-value - NS = Non-Significant p-value - EE: emotional exhaustion – PE: professional or work-related exhaustion – RE: relational or patient-related exhaustion.

5.1 Proposed Improvements

The choice of time for our investigation at the immediate aftermath of a deadly wave of COVID19 would be at the origin of a difficulty in taking a critical look at caregivers' working conditions and their state of mental health deteriorated rather by the aggressiveness of the disease than by the efforts made. It would be more judicious to carry out questionnaire surveys away from major health events.

Even if the factors favoring Burnout are not strongly present (statistically) in this study, the suffering of more than 90% of the HCWs in this ICU must trigger preventive action in order to reduce the mental and emotional burden of these employees and provide total well-being at workplace with the aim of preserving the health of the HCW and the safety of the patient.

6. Conclusion

Burnout is occurring at alarming rates in this intensive care unit. The organization of work which has undergone drastic changes during the COVID19 pandemic with endless working days, a very high number of shifts per week and per month, an unimaginable number of patients to follow and at the interface, means of insufficient protection and resources, weak recognition, all these factors seem not to have contributed to altering the mental health of caregivers. These seem adapted to the extreme working conditions that the circumstances of the COVID19 pandemic have installed. The probable cause of Burnout could be linked to the very nature of the disease, its severity and its prognosis.

References

- Acar Sevinc S Metin S, Balta Basi N, Cinar AS, Turkel Ozkan M, Oba S. Anxiety and burnout in anesthetists and intensive care unit nurses during the COVID-19 pandemic: a cross-sectional study. [Revue] // *Braz J Anesthesiol.* - 72(2):169-175.. Epub 2021 Jul 26. PMID: 34324934; PMCID: PMC8312085. - Mar-Apr 2022. - <https://doi.org/10.1016/j.bjane.2021.07.011>.
- Aljabri D Alshatti F, Alumran A, Al-Rayes S, Alsalman D, Althumairi A, Al-Kahtani N, Aljabri M, Alsuhaybani S, Alanzi T. Sociodemographic and Occupational Factors Associated With Burnout: A Study Among Frontline Healthcare Workers During the COVID-19 Pandemic. [Revue] // *Front Public Health.* - Vol. 9;10:854687. PMID: 35356019; PMCID: PMC8959574. - March 2022. <https://doi.org/10.3389/fpubh.2022.854687>.
- Burns KEA Moss M, Lorens E, Jose EKA, Martin CM, Viglianti EM, Fox-Robichaud A, Mathews KS, Akgun K, Jain S, Gershengorn H, Mehta S, Han JE, Martin GS, Liebler JM, Stapleton RD, Trachuk P, Vranas KC, Chua A, Herridge MS, Tsang JLY, Biehl M, Burnham EL. Wellness and Coping of Physicians Who Worked in ICUs During the Pandemic: A Multicenter Cross-Sectional North American Survey. [Revue] // *Crit Care Med.* - 1;50(12):1689-1700. Epub 2022 Oct 27. PMID: 36300945; PMCID: PMC9668381. - Dec 2022. <https://doi.org/10.1097/CCM.0000000000005674>.
- Duarte I Teixeira A, Castro L, Marina S, Ribeiro C, Jácome C, Martins V, Ribeiro-Vaz I, Pinheiro HC, Silva AR, Ricou M, Sousa B, Alves C, Oliveira A, Silva P, Nunes R, Serrão C. Burnout among Portuguese healthcare workers during the COVID-19 pandemic. [Revue] // *BMC Public Health.* 7;20(1):1885. PMID: 33287794; PMCID: PMC7720923. Dec 2020. <https://doi.org/10.1186/s12889-020-09980-z>.

- Hajebi A Abbasinejad M, Zafar M, Hajebi A, Taremian F. Mental Health, Burnout, and Job Stressors Among Healthcare Workers During the COVID-19 Pandemic in Iran: A Cross-Sectional Survey. [Revue] // *Front Psychiatry*. - 12;13:891430. PMID: 35633777; PMCID: PMC9133377. May 2022. <https://doi.org/10.3389/fpsyt.2022.891430>.
- Kandouci C, Meçabih F, Meçabih I, Kadari C, Megherbi N, Achouri MY, Kandouci BA, Ben Abdelaziz A. Psychosocial impact of COVID-19 among health workers in Algeria. [Revue] // *Tunis Med*. - 99(11):1015-1029. - PMID: 35288905; PMCID: PMC9390127. - Nov 2021.
- Kapasa RL, Hannoun A, Rachidi S, Ilunga MK, Toirambe SE, Tady C, Diamou MT, Khalis M. Évaluation du burn-out chez les professionnels de santé des unités de veille sanitaire COVID-19 au Maroc [Evaluation of burn-out among health professionals working at public health surveillance units COVID-19 in Morocco]. [Revue] // *Archives Des Maladies Professionnelles et De L'Environnement*. - Vol. 82(5):524-34.. - French. Epub 2021 Jun 12. PMCID: PMC8196311. Oct 2021. <https://doi.org/10.1016/j.admp.2021.06.001>.
- Khasne RW, Dhakulkar BS, Mahajan HC, Kulkarni AP. Burnout among Healthcare Workers during COVID-19 Pandemic in India: Results of a Questionnaire-based Survey. [Revue] // *Indian J Crit Care Med*. - Aug 2020. - Vol. 24(8):664-671. - PMID: 33024372; PMCID: PMC7519601. - Aug 2020. <https://doi.org/10.5005/jp-journals-10071-23518>.
- Kunno J, Supawattanabodee B, Sumanasrethakul C, Wiriyasirivaj B, Yubonpun P. Burnout prevalence and contributing factors among healthcare workers during the COVID-19 pandemic: A cross-sectional survey study in an urban community in Thailand [Revue]//*PLoS ONE*.-17(8):e0269421.Aug 2024. <https://doi.org/10.1371/journal.pone.0269421>.
- Lai J Ma S, Wang Y, Cai Z, Hu J, Wei N, Wu J, Du H, Chen T, Li R, Tan H, Kang L, Yao L, Huang M, Wang H, Wang G, Liu Z, Hu S. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. *JAMA Netw Open*. 20 [Article] // *JAMA Netw Open*. - Vol. 2;3(3):e203976. PMID: 32202646;PMCID:7090843. March 2020. <https://doi.org/10.1001/jamanetworkopen.2020.3976>.
- WHO Mental health and psychosocial considerations during the COVID-19 outbreak [En ligne] // <https://www.who.int>. - 18 March 2020. - 5 Jan 2024.
- Youssef D, Abboud E, Abou-Abbas L, Hassan H, Youssef J. Prevalence and correlates of burnout among Lebanese health care workers during the COVID-19 pandemic: a national cross-sectional survey. [Revue] // *J Pharm Policy Pract*. - 16;15(1):102. - PMID: 36527056; PMCID: PMC9756668. - Dec 2022. <https://doi.org/10.1186/s40545-022-00503-2>.

Biographies

Wissal Benhassine is MD, PhD and Professor in Occupational Medicine; she graduated from universities of Constantine and Batna 2. She is ergonomic graduated from university of Tlemcen, Algeria. She is a teacher-researcher at the Faculty of Medicine of Batna where she contributes to the training of medical students. She trains specialist doctors in Occupational Medicine. She is the head doctor of the occupational medicine department at the university hospital center of Batna Algeria where she set up an occupational pathology unit and installed a occupational mental health consultation. She conducts research in the field of mental health at work, the organization of work in healthcare structures and emergency services, the diagnosis and monitoring of work-related musculoskeletal disorders, mainly back pain. She is an expert doctor for the social insurance funds of three Wilayas. Currently, she is working on a research project on the work organization of Emergency Services and its impact on employee well-being and patient safety.

Ismahane Maache, resident doctor at the end of her residency training in occupational medicine, began this medical journey in 2019 at the University Hospital Center (CHU) of Batna2 Algeria. She took up the challenge of explore the psychological consequences of professional stress among nursing staff in particular during the COVID-19 pandemic through an end-of-study thesis entitled "burn-out among nursing staff in the COVID-19 unit (intensive care unit) during the covid-19 pandemic" and directed by Pr Benhassine wissal.

Samia Benaicha began her career as an occupational physician in a University Hospital Center in 2012 after completing her medical studies and undergoing specialized training in occupational medicine. She became interested in psychosocial risks among hospital workers during this period, and her end-of-study thesis focuses on "determining factors of psychosocial risks among caregivers". In 2015, Samia Benaicha was hired as a medical researcher at the Faculty of Medicine of the University of Batna. She participated in several epidemiological studies on the subject, including stress, professional burnout and workplace violence. The findings from their research

provided concrete recommendations to improve occupational health among hospital employees. Samia Benaicha is currently working on her PhD in occupational health and safety on work organization and psychosocial risks in healthcare settings.

Nardjesse Bensekhria is a Medical Doctor with a doctoral degree in medicine. Since 2015, she has held the position of Assistant Professor in Occupational Medicine. She is currently pursuing her doctoral research in the field of objective assessment of physical workload among healthcare providers. Her research focuses on utilizing posture and heart rate measurements, as well as implementing the World Health Organization's Workload Indicators of Staffing Need (WISN) method. She is responsible for the exploratory unit within the Occupational Medicine Department at CHU Batna. Additionally, she is actively involved in teaching and research activities at the Faculty of Medicine in Batna. Currently, she is a member of a research project investigating the organization of work in emergency services and its effects on employee well-being and patient safety.