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Psychosocial factors as determinants of biological accidents in healthcare workers

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ABSTRACT

Objective: To determine the influence of psychosocial factors on the prevalence of accidental biological exposures (ABE) in healthcare workers.

Methods: Observational, retrospective, cross-sectional, descriptive, retrospective study of 475 healthcare workers at the Clínico-Malvarrosa Health Department (Valencia) during 2.022. Sociodemographic and occupational characteristics, sleep quality with the Pisttsburg Questionnaire (PSQI), anxiety with the Generalized Anxiety Scale (GAD-7), stress with the Perceived Stress Scale (PSS-10), burnout with the Maslach Burnout Inventory (MBI) and physical activity with the International Physical Activity Questionnaire (IPAQ) were analysed. At the same time, we asked whether they had suffered from work-related ABE in the last year. Significant differences were sought by correlating ABE with psychosocial disturbances.

Results: Mean age was 38.4 years with a mean working time of 11.7 years. Forty-three per cent were nurses and 87% worked in hospitals and 13% in primary care. 26% suffered ABE in the past year. Most of them had poor sleep quality and anxiety. The mean score on PSS-10 was 12.6, (considerable stress). The burnout subscale of the MBI showed a mean score of 17, depersonalisation 6.1 and personal fulfilment 40.2. Forty-three per cent did not meet physical activity recommendations.

Predictor variables of ABE from multivariate analysis: age, sleep quality, anxiety, stress, depersonalisation, low personal accomplishment and hours sitting per day.

Conclusions: The health workers who suffered ABE, slept worse, had greater anxiety, stress and a tendency to burnout syndrome in terms of depersonalisation and professional burnout and sedentary lifestyle.

Keywords: Occupational risk factors; biological risk; occupational accident; healthcare workers; needle sticks; occupational health.

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Introduction

Occupational exposure to blood and body fluids is a serious concern for healthcare workers and represents a major risk factor for the transmission of infectious diseases such as hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) [(1)]. The risk of transmission by percutaneous injury is estimated to be 3-10% for HCV-infected blood and 7-30% for HBV [(2)].

Knowledge of the correct handling and disposal of sharps influences healthcare workers' behaviour and can lead to errors with serious consequences. It is therefore essential that organisational managers provide materials with biosafety devices [(3)]. Although the risk of injury cannot be eliminated with these instruments, it is significantly less than with conventional instruments. It has been reported that safety measures are more effective when healthcare workers are well trained in the use of such equipment [(4)].

Recording these accidents is another necessary measure to reduce the number of bio-injuries among healthcare workers. In this sense, the monitoring of cases makes it possible to introduce new strategies for improvement, new prevention plans and, in general, to improve the quality of the work of healthcare workers, while recognising their rights [(5)].

However, although the exposure of healthcare workers to fluid-borne pathogens is a very important issue, the risk factors that expose them to these pathogens are not well defined [(6)]. Based on published research on this topic, there is a significant association between increased psychosocial stress at work and the likelihood of accidental biological exposure (ABE) [(5,6)]. Healthcare workers are known to be exposed to high levels of psychosocial pressure, which can affect their behaviour and lead to poor concentration, impaired memory, low motivation and self-esteem, burnout, anxiety and depression, and work-related stress [(7)]. In addition, an increased workload can lead to a tendency towards burnout, which usually begins with physical and emotional exhaustion, detachment, cynicism, ineffectiveness and lack of personal fulfilment. In many cases, these symptoms may go unnoticed by the healthcare worker [(7,8)]. Similarly, lack of a healthy lifestyle, such as a sedentary lifestyle, can exacerbate the negative characteristics of healthcare workers' work and further predispose them to

psychosocial risk factors [9].

In general, hospitals can prevent or reduce ABE by creating a better working environment in terms of adequate staffing and resources, and by minimising emotional exhaustion. Healthcare facilities can reduce or even prevent such injuries by improving working conditions. This depends on the implementation of organisational policies [5].

This study aims to determine the influence of psychosocial factors in healthcare workers on the prevalence of their unintentional biological exposures.

Methods

Study design. Population. Sample

Retrospective descriptive epidemiological study. The total number of health workers in the Department of Health under study is 4.200-4.500 workers. If we take into account that the total number of health workers in the Clínico-Malvarrosa Health Department is 4.500, applying a confidence level of 95% and a margin of error of 5%, the optimal study population would be 354 health workers. We studied 475 healthcare workers from the Clínico-Malvarrosa Health Department in Valencia during the year 2022. Inclusion criteria included health workers such as nurses, doctors, residents in training, nursing assistants, midwives and stretcher bearers.

Variables and measurement instruments

The data were collected during the year 2.022, capturing the workers from the occupational health examinations and clinical sessions carried out by the Occupational Risk Prevention Service of the Clínico-Malvarrosa Health Department of Valencia. No discrimination was made between workers who had or had not suffered an ABE, in order to avoid bias. The following explanatory variables were analysed for each of the 475 workers: quality of sleep, possibility of anxiety and stress and the three subscales that define burnout syndrome -emotional exhaustion, depersonalisation and low personal fulfilment-. Each employee was also asked about possible exposure to biological accidents during the last year (outcome variable).

For the study of sleep quality, the PSQI questionnaire was used, consisting of 24 items, 19 of which are taken into account for correction. It is divided into 7 dimensions: subjective

sleep quality, latency, duration, efficiency, sleep disturbances, medication use and daytime dysfunction. It is answered on a Likert-type scale ranging from 0 to 4. For its correction, a sleep profile is obtained for each of the dimensions ranging from 0 to 3 and a total score ranging from 0 to 21 [10]. In addition to the numerical value, the results of this questionnaire were dichotomised as good sleep quality (5 points or less) or poor sleep quality (more than 5 points).

For the study of generalised anxiety, the GAD-7 questionnaire was chosen, consisting of 7 Likert-type response items from 0 to 3 that include the symptoms and disability associated with the disorder. For its correction, a total score is obtained from the sum of the scores of all the items, which can range between 0 and 21. In the original version, the authors propose a cut-off point of greater than or equal to 10 [11].

The PSS-10 questionnaire, a short version of the PSS-14 scale, was used to determine stress levels. The PSS-10 score is obtained by inverting the scores of items 6, 7, 8, and 9 and adding the 10 items together. It is a direct scale, i.e. the higher the score, the higher the stress levels [12].

For the assessment of burnout syndrome, the Maslach Burnout Inventory (MBI) questionnaire was used, consisting of 22 items in the form of statements on the feelings and attitudes of the professional at work. It measures the 3 aspects of Burnout Syndrome on the basis of three subscales:

1. Emotional exhaustion or burnout subscale: It assesses the experience of being emotionally exhausted by the demands of the job. It consists of 9 questions (1, 2, 3, 6, 8, 13, 14, 16, 20.) Maximum score 54.

2. Depersonalisation subscale: Assesses the degree to which one recognises attitudes of coldness and detachment. It is made up of 5 items (5, 10, 11, 15, 22.) Maximum score 30.

3. Self-fulfilment subscale: Assesses feelings of self-efficacy and self-fulfilment at work. It consists of 8 items (4, 7, 9, 12, 17, 18, 19, 21.) Maximum score 48 [13].

For the evaluation of the level of physical exercise, the workers were given the International Physical Activity Questionnaire - Short Form (IPAQ-SF) which contains 7 questions. This questionnaire was used to determine the total minutes of physical activity per week and the hours of sedentary time [14].

Statistical analysis

First, descriptive statistics were performed using absolute and relative frequencies for categorical variables, and mean and standard deviation (SD) for quantitative variables. Then, a bivariate analysis was performed to determine the relationship between the different socio-demographic characteristics, physical activity, sleep quality, stress, anxiety and burnout with the occurrence of a biological accident, using Pearson's chi-square test and estimating the odds ratio (OR) with its respective 95% confidence interval (CI). When the normality analysis was performed on the quantitative variables, all obtained a value of $p<0.001$, so the non-parametric Kruskal-Wallis test was used.

Finally, a multivariate analysis was performed using binary logistic regression. The aim of this analysis was to develop a predictive model of biological accident risk, using the backward stepwise variable selection system of SPSS. With the variables selected in the multivariate model, the predictive capacity was calculated using the area under the ROC curve (AUC). All statistical analysis was carried out with the SPSS statistical program.

Results

Description of the study sample

Table 1 shows the descriptive analysis of the variables analysed. The mean age of the workers studied was 38.4± 11.8 years, with a mean working time of 11.6 ± 10.8 years. Forty-three per cent of the subjects (205) were nurses and 87% (413) worked in hospitals, compared with 13% in primary care. Of the 475 workers, 26% (123) had experienced ABE in the previous year. According to the results of the Pittsburgh Scale and GAD-7, the majority of healthcare workers had poor sleep quality and high levels of anxiety. The mean score on the PSS-10 scale was 12.6 ± 6.2 (considerable stress). With regard to the MBI, the burnout subscale has a mean of 17 points ± 10.7, the depersonalisation subscale a mean of 6.1 ± 4.9 and the self-fulfilment subscale a mean of 40.2 ± 6.5. Forty-three per cent of workers (205 of the total) did not meet the physical activity recommendations.

Table 1. Descriptive analysis of the variables included in the study.

Variables		n (%)	Mean ± SD
Gender	Female	380 (80)	
	Male	95 (20)	
Age, years		475	38.4 ± 11.8
Time worked		475	11.7 ± 10.8
Occupation	Nurse	205 (43)	
	Resident nurses	23 (5)	
	Stretcher-bearer	40 (8)	
	Doctor	50 (11)	
	Resident doctors	25 (5)	
	Nurse assistant	127 (27)	
	Midwives	2 (0)	
	Others	3 (1)	
Assistance	Primary care	62 (13)	
	Hospital	413 (87)	
Service	Primary care	62 (13)	
	Surgical speciality	209 (44)	
	Medical speciality	204 (43)	
BIOLOGICAL ACCIDENTS	Yes	123 (26)	
	No	352 (74)	
Pittsburgh		475	7.3 ± 3.7
Sleep quality	Good	169 (36)	
	Poor	306 (64)	
GAD-7		475	6.6 ± 5
Anxiety	No	194 (41)	
	Yes	281 (59)	
PSS-10		475	12.6 ± 6.2
MBI	Burnout subscale	475	17 ± 10.7
	Despersonalization subscale	475	6.1 ± 4.9
	Self-fulfilment subscale	475	40.2 ± 6.5
Total minutes of physical activity		475	271.9 ± 305.5
Sitting time per day (hours)		436	12 ± 4
Compliance with WHO physical activity recommendations	Yes	270 (57)	
	No	205 (43)	

Bivariate analysis

It was performed between the quantitative variables and the risk of biological accident (Table 2), with the probability of suffering an ABE being statistically significant among younger workers, those who slept less well, those who showed more stress and anxiety, and those who showed high depersonalisation, exhaustion and low personal fulfilment. Qualitative variables and ABE were then analysed (Table 3). A statistically significant association was found with being a nurse, reporting poor sleep quality or showing high levels of anxiety.

Table 2. Analysis of quantitative variables in relation to exposure or not to biological accidents.

	Biological accidents (Mean ± SD)		***p***			
	YES	**NO**	**Kruskal-Wallis**	**OR 95%CI**	***OR 95%CI**	***p***
Age, years	35.5 ± 9.8	39.4 ± 12.3	0.004	0.030 (1.012-1.050)	0.034 (1.011-1.058)	0.002
Time worked	10.8 ± 9.7	11.9 ± 11.2	0.924	0.010 (0.991-1.030)		
Pittsburgh	9 ± 3.4	6.7 ± 3.7	<0.001	-0.161 (0.804-0.901)		
GAD-7	8.9 ± 5	5.7 ± 4.7	<0.001	-0.123 (0.848-0.923)	-0.140 (0.808-0.935)	<0.001
PSS-10	13.9 ± 6.6	12.1 ± 6.1	0.033	-0.046 (0.924-0.987)	0.111 (1.053-1.186)	<0.001
MBI Sub. burnout	20.9 ± 9.9	15.6 ± 10.6	<0.001	-0.045 (0.937-0.974)		
MBI Sub. despersonalization	8.4 ± 4.2	5.3 ± 4.9	<0.001	-0.127 (0.843-0.920)	-0.062 (0.891-0.991)	0.021
MBI Sub. self-fulfiment	37.2 ± 5.7	41.3 ± 6.5	<0.001	0.091 (1.061-1.132)	0.085 (1.040-1.139)	<0.001
Total minutes PA	281.8 ± 311.1	268.4 ± 303.9	0.702	0 (0.999-1.001)		
Sitting time per day (hours)	3.8 ± 2	12 ± 4.2	0.067	0.096 (0.987-1.227)	0.134 (1.013-1.291)	0.026

Multivariate analysis

The next step in the analysis was to develop a predictive model of biological accident risk (Table 2 and Table 3). The multivariate analysis showed age with an OR of 0.34 (95% CI: 1.011-1.058), sleep quality (good or poor) with an OR of -1.045 (95% CI: 0.184-0.672), GAD-7 questionnaire score with an OR of -0.14 (95% CI: 0.808-0.935), PSS-10 questionnaire with an OR of 0.111 (95% CI: 1.053-1.186) and MBI with an OR of -0.062

(95% CI: 0.891-0.991), and for self-fulfilment with an OR of -0.062 (95% CI: 0.891-0.991) and self-fulfilment with an OR of 0.085 (95% CI: 1.040-1.139) and sitting hours per day with an OR of 0.134 (95% CI: 1.013-1.291).

The ROC AUC (Figure 1) of this model was 0.802 (95% CI: 0.76-0.85), which is considered good predictive ability according to Swets' criteria [15].

Figure 1. ROC curve

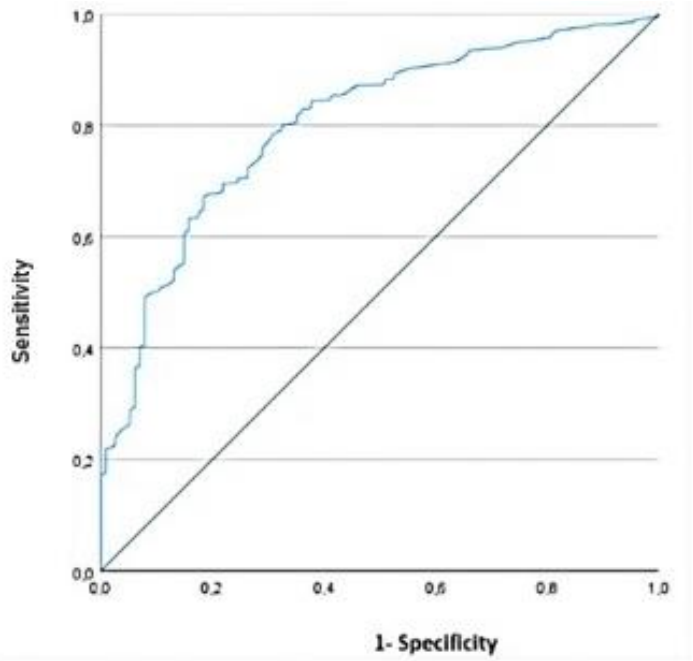

Table 3. Analysis of qualitative variables in relation to exposure or not to biological accidents

		Biological accident n(%)		*p*			
		YES	**NO**	**Chi²**	**OR 95%CI**	***OR 95%CI**	***p***
Gender	Female	99 (80)	281 (80)	0.875	reference		
	Male	24 (20)	71 (20)		0.041 (0.622-1.747)		
PROFESSION	Nurse	71 (58)	134 (38)	<0.001	reference		
	Resident nurses	5 (4)	18 (5)		0.646 (0.680-5.352)		
	Stretcher-bearer	2 (2)	38 (11)		2.309 (2.360-42.948)		
	Doctor	14 (11)	36 (10)		0.309 (0.690-2.692)		
	Resident doctors	11 (9)	14 (4)		-0.394 (0.291-1.563)		
	Nurse assistant	20 (16)	107 (30)		1.042 (1.623-4.950)		
	Midwives	0 (0)	2 (1)				
	Others	0 (0)	3 (1)				
ASSISTANCE	Primary care	24 (20)	38 (11)	0.013	reference		
	Hospital	99 (80)	314 (89)		0.695 (1.146-3.503)		
SERVICE	Primary care	24 (20)	38 (11)	0.032	reference		
	Surgery speciality	54 (44)	155 (44)		0.595 (0.997-3.295)		
	Medical speciality	45 (37)	159 (45)		0.803 (1.214-4.102)		
SLEEP QUALITY	Good	17 (14)	152 (43)	<0.001	reference	reference	0.001
	Poor	106 (86)	200 (57)		-1.556 (0.121-0.367)	-1.045 (0.184-0.672)	
ANXIETY	No	23 (19)	171 (49)	<0.001	reference		
	Yes	100 (81)	181 (51)		-1.413 (0.148-0.401)		
Compliance with WHO physical activity recommendations	Yes	66 (54)	204 (58)	0.408	reference		
	No	57 (46)	148 (42)		-0.174 (0.556-1.269)		

Discussion

The objective of this study was to know the influence of psychosocial factors on the prevalence of biological accidents among healthcare workers. The results show that workers who have suffered an ABE are younger, have poorer sleep quality, greater stress, anxiety and sedentary lifestyle and worse results on the MBI in the personal accomplishment and depersonalization subscales.

On the one hand, age seems to be a determining factor when experiencing ABE. Other studies have shown how the majority of these accidents occur in workers between 20 and 30 years old, which may be due to their lack of experience, something that would lead them to feel unsafe when performing procedures [16]. There could, therefore, be a correlation between lower ability –linked to age or years of experience– and ABE [17].

On the other hand, poor sleep quality may also be influencing ABE [18]. 32% of healthcare workers report that they do not get enough sleep. Drowsiness and fatigue can reduce attention, increase the probability of making errors during work and affect the safety of both the patient and the worker themselves [19,20]. A study of Australian nurses confirmed that the frequency of work errors increased considerably when they were tired [19]. This may be determined by long working hours and shift work [18,19]. Valent et al. [21] demonstrated that Emergency Medical Services workers experienced biological accidents up to approximately two times more in the case of lack of sleep and three times more in the case of fatigue. Employees who work in shifts are more particularly exposed to fatigue, thus confirming that the design of good work schedules, the establishment of work strategies, as well as an adequate periodic evaluation of the quality of workers' sleep can be very useful.

It has been proven that fatigue caused by the work day can negatively interfere with the activities carried out during work since it causes not only tiredness, but also difficulty concentrating, irritability, poor communication skills and worse emotional coping at work. Neurocognitive performance decreases, encouraging work-related accidents and psychological illnesses and negatively affecting patient care [21-23]. García-Batista et al. (24) confirmed the association between sleep problems and work-related injuries. Specifically, we can talk about a 1.6 times greater risk of injury at work among workers who sleep poorly, with approximately 13% of work injuries attributable to sleep problems. Likewise,

the possibility that healthcare workers have worsened their sleep quality after the SARS-CoV-2 pandemic must be considered. Masoumi et al. [25] concluded that the average duration of night time sleep decreased by 38 minutes among health professionals after the pandemic.

If we want to reduce the risks associated with poor sleep, it is important to make sleep a priority in work organization systems among healthcare workers. As stated by Uehli et al. [23] in their meta-analysis, organizational managers should make periodic evaluations to examine the extent to which work schedules may be affecting performance, alertness, sleep, and, therefore, injuries, work errors and other incidents.

In addition to this, the present study also corroborates that high levels of anxiety and stress are associated with an increase in ABE. A study carried out in March 2.019 with 1.257 healthcare workers showed that more than half of them presented symptoms of depression, anxiety, insomnia and anguish [24].

High stress scores in healthcare workers have a lot to do with long work hours, staff shortages, managing life-threatening illnesses, working in emergency situations, teaching colleagues, patients do not comply, exposure to biological fluids, excess noise, complex procedures, as well as dealing with family members [21,26]. This is very relevant if we take into account that work stress can decrease empathy towards patients, increase aggressiveness and, therefore, affect the quality of the services provided. Furthermore, high levels of stress are associated with care errors towards both the patient and the healthcare provider themselves, demonstrating the correlation with ABE [24]. Some of the interventions that may be beneficial to reduce work stress would be: clearly defining the tasks and roles of each worker, educating in safe work practices or good communication between colleagues [27]. If we pay attention to the psychological aspects of our healthcare workers, we will not only be promoting health in this group, but we will also be making an investment in the quality of the care provided [20]. This would increase the feeling of security at work and could significantly influence ABE rates [27].

Associated with high levels of stress and anxiety would be professional burnout or burnout syndrome. This condition appears as a response to a prolonged situation of interpersonal stressors caused by work and manifested by exhaustion, depersonalization and reduced personal fulfilment. Its control and prevention involves the implementation of

interventions focused on the individual, as well as structural and organizational measures [28].

Lastly, the study shows a greater exposure to biological accidents among sedentary healthcare workers. Overall, 1 in 4 adults currently do not meet the global physical activity recommendations set by the World Health Organization (WHO). Physical activity can and should be integrated into the environments in which people live and work [29]. Promoting healthy behaviours among healthcare workers can improve well-being and professional performance in addition to setting a better example for patients [30]. Research in the United States shows that nurses who worked shifts for more than 20 years had less healthy lifestyles [31] and an association has been seen between mental conditions such as anxiety and stress and lack of physical activity [32]. In general, people who practice physical exercise have greater psychological well-being [33], so if the reduction in levels of stress and anxiety can be associated with the reduction of ABE, the increase in physical activity can also [32].

Limitations of the study

It should be considered that psychosocial factors affecting healthcare workers are not always work-related, but can also be influenced by personal circumstances.

Conclusions

The health workers who suffered ABE were those who were younger and had worse results in sleep quality, higher levels of anxiety, stress, as well as a greater tendency to burnout syndrome in terms of depersonalization and professional burnout. Likewise, these workers presented results indicative of a sedentary lifestyle in the IPAQ questionnaire.

Final observations

Training in ABE prevention for workers, especially the most inexperienced, should be insisted on. On the other hand, it would be necessary to carry out a good work organization, with adequate staff rotations that facilitate rest, as well as, to the extent possible, conveniently structure the workload with the aim of controlling levels of anxiety, stress or burnout syndrome among workers. A good instrument for this could be the promotion of physical activity that favours the psychological well-being of healthcare workers.

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At all times, the data provided by the participants in the study have been protected, with the surveys being guarded exclusively by the main researcher. All procedures carried out during the study were carried out in accordance with current ethical standards. The data obtained was anonymous since the information was collected by assigning a fictitious identifier. Access to these data was exclusive to the researcher, guarding and using them only to fulfil the purposes of the study. The procedures were followed in accordance with the Helsinki Declaration revised in 2.013.

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