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## INTELLIGENT SYSTEMS OF DECISION-MAKING AND PROBLEMS OF COMPUTATIONAL INTELLIGENCE



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### MACHINE LEARNING APPROACH FOR EARLY DETECTION OF BURNOUT FACTORS IN MEDICAL PROFESSIONALS

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Burnout is characterized by emotional exhaustion, depersonalization, and a diminished sense of personal accomplishment, which can lead to severe physical and mental health consequences [1, 2]. The increasing demands of the medical profession, including long working hours, high patient loads, and administrative burdens, exacerbate this issue. Furthermore, the high-stress environment, often coupled with insufficient support and resources, contributes significantly to the development of burnout. Early identification of burnout symptoms and understanding its contributing factors are essential for implementing effective preventive measures.

A method of determining criterion-significant statements according to the questionnaire for psychological diagnosis of professional burnout "Maslach Burnout Inventory – General Survey" (MBI-GS) has been developed [1].

The Maslach Burnout Inventory – General Survey (MBI-GS) [2] consisted of 16 items divided into burnout risk scales: "emotional exhaustion" (ee), "depersonalization/cynicism" (zy) and "professional efficiency" (ef). Respondents were asked to provide answers to each statement using a point scale from 0 points (never) to 6 points (every day). The mean of points on each of these scales shows the degree of expressiveness of "professional burnout" and is defined as low, moderate/average or high (Table 1).

Table 1

Scale	The degree of expressiveness		
	low	average	High
"Emotional exhaustion"	≤ 2,00	2,01 - 3,19	≥ 3,20
"Depersonalization/cynicism"	≤ 1,00	1,01 - 2,19	≥ 2,20
"Work efficiency"	≤ 4,00	4,01 - 4,99	≥ 5,00

198 medical workers of different categories took part in the study: oncology doctors, anesthesiologists and emergency medical workers. Among them, 149 people (75.3%) belonged to the medical staff, and 39 (19.7%) - to the paramedic category. The gender distribution was almost equal, with 47% men and 53% women. The average age of the study participants was  $38.96 \pm 0.94$  years, and the average length of service was  $14.71 \pm 0.91$  years. These data indicate that mainly middle-aged persons with significant professional experience perform medical activities in this field.

The analysis of the distribution by gender and length of service within certain professions showed the following. With a mean age of  $39.75 \pm 1.28$  years and a mean length of service of  $14.19 \pm 1.30$  years, workers specializing in resuscitation were divided between men (48%) and women (52%). In the group of oncology doctors, women predominated (54%), and the average age was  $46.51 \pm 2.23$  years, while the average length of service was  $22.47 \pm 2.20$  years. EMS professionals were the youngest of all study participants, with the average age of  $35.13 \pm 1.44$  years and the average length of service of  $11.88 \pm 1.35$  years. This group included 42 men (48%) and 46 women (52%).

Using the logistic regression method, all study participants were divided into three groups (healthy individuals, a group of prepathology of the development of professional burnout, and a group of individuals with signs of burnout). So, the group of prepathology was 43 (21.7%) people among the general sample of medical workers (Fig. 1).

The next stage was to determine the informative questions from the MBI-GS questionnaire, which were specific to the group of the prepathological state. With an accuracy factor of  $0.84 \pm 0.17$ , questions from the scales "depersonalization/cynicism" and "emotional exhaustion" were set as informative indicators, namely:

6 ee – I feel burnt out from my work.

8 zy – I have become less interested in my work since I started this job.

13zy – I just want to do my job and not be bothered.

14 zy – I have become more cynical about whether my work contributes anything.

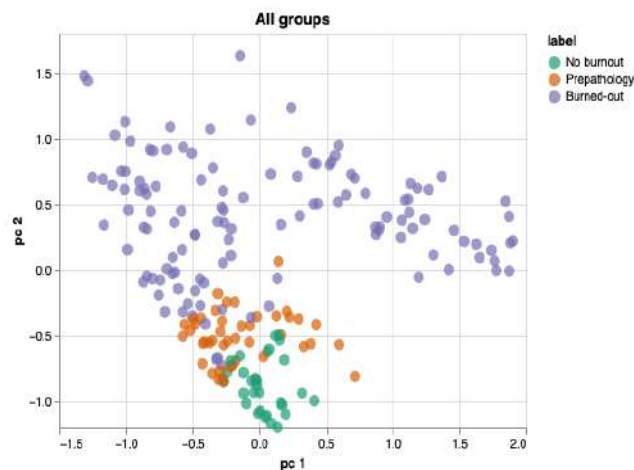


Figure 1. Visualization of the general model of the formation of the prepathology group among medical workers.

Therefore, taking into account the general distribution of medical workers according to the scales of the questionnaire and the informative criteria of this condition determined with help of the Eli5 explanation, no specific informative indicators were established for each specialty (oncology, anesthesiology and emergency medical care). Therefore, it was decided to conduct a deeper analysis.

The results of the study on emotional well-being and risk of burnout in the study groups of health care professionals are presented in Table 2.

Table 2

Distribution of dependence on the level of expressiveness of burnout indicators according to the MBI-GS scales among medical professionals

MBI scales	Emergency medical workers n = 88 (%)	Anesthesiologists n = 73 (%)	Oncology doctors n = 37 (%)
Emotional exhaustion	36 (40.9 %)	38 (52.1 %)	23 (62.2 %)
	19 (21.6 %)	19 (26.0%)	6 (16.2 %)
	33 (37.5 %)	16 (21.9 %)	8 (21.6 %)
Depersonalization/cynicism	31 (35.2 %)	25 (34.2 %)	16 (43.2 %)
	23 (26.1 %)	19 (26.0%)	12 (32.4 %)
	34 (38.6 %)	29 (39.7 %)	9(24.3 %)
Labor efficiency	11 (12.5 %)	36 (49.3 %)	9 (24.3 %)
	10 (11.4 %)	8 (11.0 %)	5 (13.5 %)
	67 (76.1 %)	29 (39.7 %)	23 (62.2 %)

The developed mathematical model made it possible to identify predictors of the potential development of professional burnout syndrome among practicing doctors according to the Maslach Burnout Inventory (MBI-GS).

The applied approach contributed to the early recognition of signs of burnout and provided information about the possible causes of the development of this syndrome. It was established that among 198 respondents, the total group of prepathology consisted of 43 medical workers for whom a pronounced phenomenon of cynicism was inherent.

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