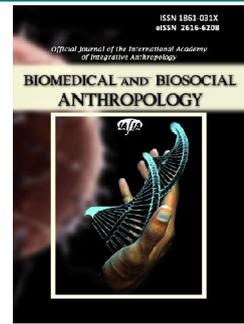




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# The effectiveness of the process of restoring the functional status of servicemen who were in the area of the Joint Forces operation

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*Psychological rehabilitation of combatants is especially relevant today, when the hybrid war in the east of our country has been going on for eight years. The scale of this phenomenon in Ukrainian society requires an active study of the psychological problems of servicemen that have emerged during this time. The aim of the work is to determine the effectiveness of medical rehabilitation of servicemen after being in the combat zone according to the indicators of emotional burnout. A specially designed questionnaire was used to assess the impressions of combat and domestic problems that arise in the military in the area of the Joint Forces Operation (JFO) in relation to the effects of internal and external factors of combatants. To determine the development of chronic fatigue, the method "Diagnosis of emotional burnout" by Boyko V. V. was used. Statistical analysis of the obtained results was carried out with the involvement of methods of parametric and nonparametric statistics, cluster, stepwise multiple correlation and stepwise discriminant analysis using the software package STATISTICA 13.3. Analysis of the obtained data showed that six psychophysiological qualities ( $R_s=0.67$ ) were the most related to the parameter of stress load "before" treatment. The list of informative characteristics indicates the high activity of the body of servicemen, the dependence of endurance of their nervous system, the level of concentration and reliability of activity from the received stress. After treatment, the number of informative psychophysiological indicators decreases significantly, and the strength of the connection with stress increases slightly ( $R_s=0.78$ ), which indicates the gradual restoration of relevant body functions. It was found that the characteristics of emotions are associated with stress ( $R_s=0.52$ ). Before treating these relationships, there are three feelings: "self-dissatisfaction", "caged", "emotional and moral disorientation". After treatment, this connection is slightly reduced along with the elimination of the emotion of "self-dissatisfaction", which characterizes the gradual ordering, systematization of the feelings of the combatant, starting with the relationship to himself. It was found that the average efficiency of 10-day treatment is 16.7 %, which indicates the benefit of restorative procedures. Information technology has been developed that allows to quantify the outcome of treatment, the use of which will allow a meaningful approach to the treatment process, to carry out dynamic control of its results and improve rehabilitation techniques.*

**Keywords:** psychophysiological qualities, emotional burnout, medical rehabilitation, participants in hostilities.

### Introduction

The problem of psychological rehabilitation of combatants is especially relevant today, when the hybrid war in the east of our country has been going on for seven years. The scale of this phenomenon in Ukrainian society requires an active study of the psychological problems of servicemen, the creation of special centers throughout the country to provide social, psychological and medical assistance to former combatants and especially those who

received injuries and mutilations [15]. It is known that psychophysiological disorders in victims of armed conflicts are largely due to combat stress, which is a destabilizing and pre-pathological condition that limits the body's functional reserves and increases the risk of disintegration of mental activity and persistent somatovegetative dysfunctions therefore, it can lead to combat stress disorders [5].

Formed in a combat situation functional systems, whose activities are aimed at saving lives, form a certain emotional and behavioral stereotype. It should be noted that the combat and peaceful situation is so different that after leaving the war zone a person needs to restore the functional systems of "peacetime" by including adaptation mechanisms aimed at restoring and developing behavioral programs adequate to living conditions. According to numerous clinical observations, the mismatch between a person's aspirations, ideas, possibilities of action often leads to various emotional disorders, which are most often manifested by fear, sadness, mood lability, depression or anger, increased aggression. In the case of impaired mental adaptation, there is a different quality and severity of disorganization of social contacts, reduced opportunities for self-regulation of their own actions, increased egocentric behavior, changes in attitudes to work, and so on. Changing the somatic status associated with injury often deprives such people of real prospects in later life, necessitates a restructuring of values [8, 16].

However, in addition to mental health, it requires the preservation and restoration of physical condition, which requires the urgent introduction and active application of effective preventive and rehabilitation measures. Rehabilitation, as a process of restoring the physical, mental and social resources of a serviceman and a participant in hostilities, should be integrative [10, 18].

The maladaptation of combatants leads to the development of specific functional states that require appropriate psychophysiological correction and rehabilitation. In this regard, the study of the patterns of functional recovery of the body in the process of rehabilitation, recovery of human capacity is an important scientific and practical task today, the importance of which is difficult to overestimate, especially in the Joint Forces Operation (JFO) and the growing number of combatants actions of excessive stress with direct participation in hostilities [2].

*The aim of the work* is to determine the effectiveness of medical rehabilitation of servicemen after being in the combat zone according to the indicators of emotional burnout.

### Materials and methods

The study was conducted on the basis of the Military Medical Clinical Center of the Central Region (MMCC CR). 30 contract servicemen were selected for inpatient treatment at the Medical Rehabilitation and Rehabilitation Department after a long stay in the combat zone. Valuable information about human actions of the external and internal environment, the potential for its adaptation are his sensations (reflection of certain properties of objects, phenomena of the external and internal world) and perception (visual reflection of current sensory objects and phenomena of reality), which contribute to the selection of the whole set of basic features with simultaneous distraction from the insignificant [4, 11, 14]. For example, in the performance of tasks of service and operational activities of border guards an important place is occupied by the

process of correct perception of space, movement and time. As evidenced by the experience of troops in the "hot spots", perception depends on the level of knowledge, mood, experience and feelings experienced in this and the past, the expectation and desire to see something in the perceived phenomena [11, 13]. Therefore, the success of professional adaptation depends on the peculiarities of perception and its compliance with the conditions of professional activity.

To assess the functional status, it is advisable to use techniques that analyze the perception of servicemen of possible emergencies, which are determined by the specific nature of their activities, including complexity, inconsistency, uncertainty and dynamism of the operational environment, decision-making and the lives of comrades, prolonged physical and informational discomfort, domestic inconvenience and others.

With the help of a specially designed questionnaire that reflected the combat and domestic problems that arise in the military in the area of JFO, an assessment of their impressions of the factors of internal and external environment of combatants [7, 19].

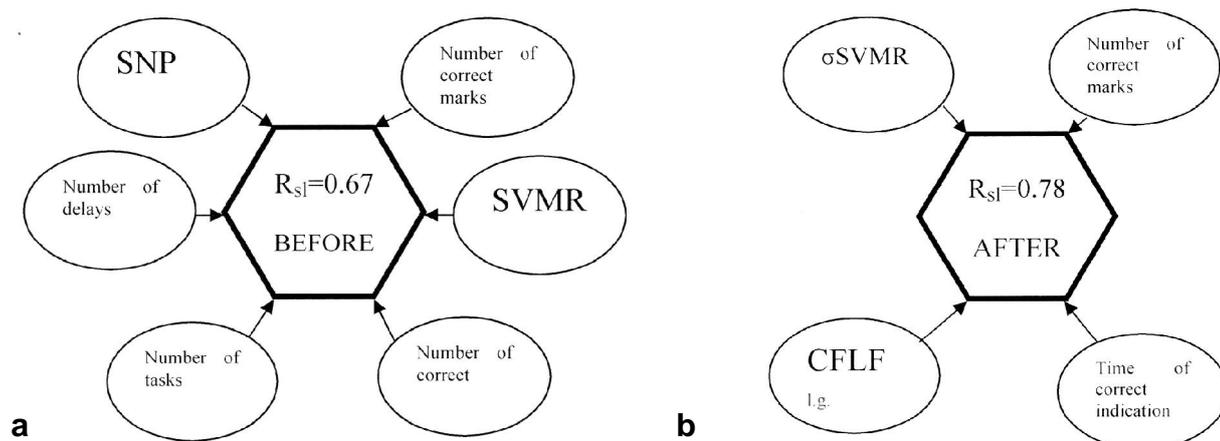
To determine the tendencies to the development of chronic fatigue, the method "Diagnosis of emotional burnout" was used Boyko V. V. [3]. This technique is aimed at diagnosing the syndrome of emotional burnout and allows you to systematically and in detail analyze the severity of 12 symptoms corresponding to one of the three phases of development of this syndrome: stress ("S"), resistance ("R") and exhaustion ("E").

To determine the psychophysiological status of servicemen, modified methods were used, implemented using software and hardware for psychophysiological research based on the device "PFI-2" [9]. The following were recorded: critical flicker fusion rate (CFF) to green on the right and left eye (CFF r.e. or CFF l.e.), time of simple visual-motor reaction (SVMR), time of complex visual-motor reaction (CVMR) to light, functional mobility of nervous processes (FMNP), strength of nervous processes (SNP), dynamics of nervous processes (DNP), reaction to a moving object (RMO): number of advances and delays, reaction time to a moving object in advance (RMOa), time of reaction to a moving object with delay (RMOd), concentration of attention (CA), time spent on the test for attention (TS), time of correct answer in the test with Landolt's rings (TCA), memory capacity (MC), etc.

Statistical analysis of data was performed using methods of parametric (Student's t-test) and non-parametric (Mann Whitney's U-test) statistics, cluster, step-by-step multiple correlation and step-by-step discriminant analysis using software package STATISTICA 13.3 (license AXA905I924220FAACD-N).

### Results

Data on the recovery effect of servicemen were obtained on the first and tenth days of their stay in the MMCC CR. Such a short period of time between examinations was due to the fact that the duration of treatment was related not



**Fig. 1.** The results of the selection of informative psychophysiological characteristics regarding the level of stress. a - informative psychophysiological characteristics for treatment; b - informative psychophysiological characteristics after 10 days of treatment.

only to the state of health of patients, but also to the possible limitation of their stay in the hospital for official reasons. It is worth noting another important feature of the surveyed contingent. The fact is that this contingent was heterogeneous not only in terms of health, but also for other, non-human reasons, among which the time spent in the JFO area was important. All these factors made the studied contingent heterogeneous.

*Identification of informative psychophysiological and psychological parameters of servicemen, as well as the characteristics of their impressions of the factors of the combat environment and living conditions.* To identify the dependence of the psychophysiological state of servicemen on the level of SL, a step-by-step multiple correlation analysis of these indicators was conducted before and after the rehabilitation period. The results of this analysis with a set of psychophysiological indicators are shown in Figure 1.

Six psychophysiological qualities were the most related to the SL parameter before treatment: SNP, number of correct marks, SVMR, number of correct answers, number of tasks, number of delays (see Fig. 1a). The value of the multiple correlation coefficient  $R_{sl}=0.67$  ( $p<0.02$ ) was quite significant, which indicated a high determinism (45 %) of a number of psychophysiological indicators from SL. The list of informative characteristics indicates the high activity of the body of servicemen, the dependence on the endurance of their nervous system, the level of concentration and reliability of SL.

After treatment, the number of informative psychophysiological indicators decreases significantly, which indicates the gradual restoration of relevant body functions (see Fig. 1b). That is, the dependence of the functional state of servicemen on SL decreases. The level of mobilization of body functions ( $\sigma$ SVMR), the lability of nervous processes, which indicates the activation of recovery processes, the time of correct indication in the assessment of short-term memory. But the dependence of reliability on the level of SL does not disappear. The strength of the

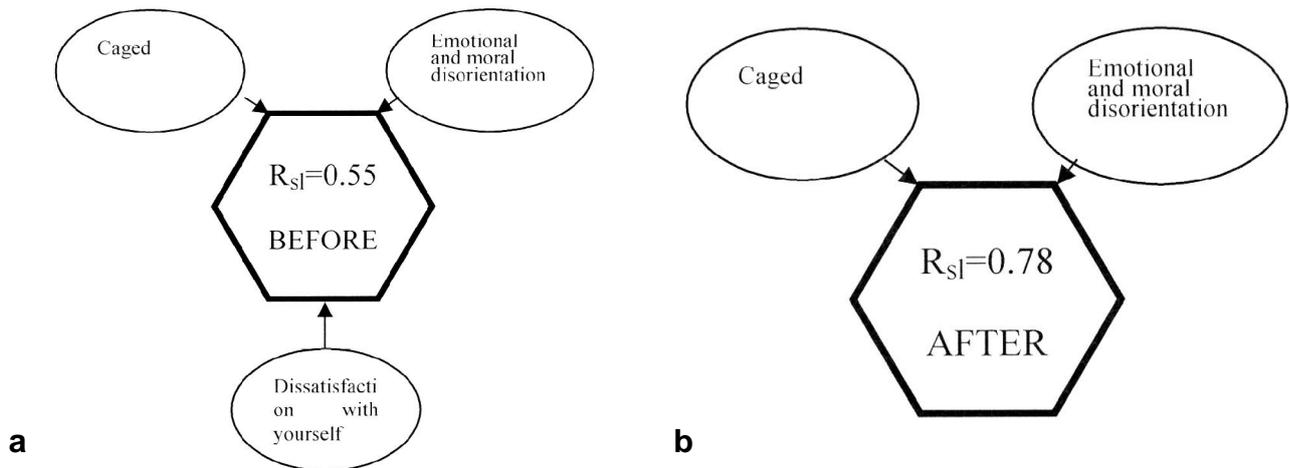
relationship between these parameters increases after treatment ( $R_{sl}=0.78$ ;  $p<0.001$ ). Therefore, the effect of SL on psychophysiological functions is fixed at 61 %. In principle, increasing the impact of SL on psychophysiological functions while reducing the number of functions affected by this load after treatment can be considered positive, because in this case increases not only the autonomy of some functions, but also activates the impact on important professional characteristics attention and lability of nervous processes.

Emotional characteristics are also related to SL (Fig. 2). Before the treatment of these connections, there are three feelings: dissatisfaction with yourself, being driven into a cell, emotional and moral disorientation (see Fig. 2a).

The strength of this connection is  $R_{sl}=0.55$  ( $p<0.02$ ), which declares the presence of a 30 % explanation for the fluctuations of emotional manifestations relative to SL. After treatment, this relationship decreases slightly  $R_{sl}=0.52$  ( $p<0.02$ ) in parallel with the decrease in explanatory power relative to SL (26 %). Important is the fact that in the latter case the emotion of self-dissatisfaction after treatment is eliminated, which indicates the primary recovery of self-esteem and characterizes the gradual ordering, systematization of their feelings, starting with the relationship to himself (see Fig. 2b).

The greatest correlation between SL is observed with the feelings of the combatant factors of the combat environment and vital factors. It reaches the level of  $R_{sl}=0.96$  ( $p<0.001$ ) with the power to explain changes in sensations from SL 93 %. Step-by-step multiple correlation analysis identified 18 informative characteristics of the relevant sensations, 50 % of which relate to the factors of the combat environment, and 50 % - to the factors of life (life). The revealed strong connection of the analyzed data testifies to the greatest degree of explanatory force of changes of SL on impressions from influence of factors of the working environment.

*Features of the influence of stress on the level of sensations of factors of the working environment.* The logic



**Fig. 2.** The results of the selection of informative characteristics of emotional burnout in relation to the level of stress. a - informative characteristics of emotional burnout before treatment; b - informative characteristics of emotional burnout after 10 days of treatment.

of the study stimulates to clarify the features of the presence of a strong connection between SL and the level of sensations from the influence of environmental factors and life. For this purpose, with the involvement of cluster analysis (k-means method), data on the differentiation of sensations under the influence of environmental factors were obtained. The entire surveyed contingent was divided into three groups. The number of groups received is related to the following considerations. In any sample, there are polar data that characterize the degree of differences in human impressions. At the same time, there is objectively a "middle" group of impressions whose representatives are "amorphous", disordered. Characteristics of impressions from the action of environmental factors in the selected groups are shown in table 1.

Consideration of the data presented in the table allows us to identify groups with unambiguously polar sensations from the influence of environmental factors. Representatives of these groups can be conditionally called "hypersensitive" (with mostly higher values of impressions) and "hyposensitive". It should be noted that there is a third group, the directions of changes in which in comparison with group 1 and group 2 are not stable. Perhaps this effect is due to the small number of this group - 6 people. Therefore, the data of this group will not be analyzed in the further analysis.

Considering the polar groups, it should be noted that the vast majority (74 %) of assessments of sensations in these groups differ significantly. This phenomenon suggests that the assessments: fear of stepping on a mine (stretching), fear of hitting a landmine, fear of being captured, death of a comrade-in-arms, concern about the consequences of personal mistakes (fear of making a mistake, own incompetence) are the greatest for both polar groups, the impressions of which have become saturated. The average levels of impressions according to these estimates are probably due to the personal qualities of combatants, which form the attitude to certain extreme factors.

Characteristics of impressions from the action of vital factors (life) in the selected groups are shown in table 2.

The grouping according to the criteria of factors of the working environment made it possible to obtain data on the assessment of the impressions of factors of life. As in the previous case, two groups with polar impressions and an "amorphous" group with contradictory directions of change of these estimates were formed by cluster analysis. In the groups that can be defined as "hypersensitive" and "hyposensitive" to environmental factors, 65 % of indicators had significant changes. Among the data that did not differ significantly in these groups are: high humidity, lack of equipment, comfort of being in the team (in combat), comfort of being in the team (at home), frequent conflicts with commanders, conflict situations with colleagues and remoteness and anxiety for loved ones. Of these parameters: the comfort of being in the team (in battle), the comfort of being in the team (at home) and remoteness and anxiety for loved ones had estimates that exceeded 50 c.u. The latter indicates the importance of these impressions, which are formed due to the effect of team cohesion in any service environment and personal feelings towards family and friends.

Summarizing the data obtained, it should be noted that the division into groups is a constructive method for determining the characteristics of the presence of servicemen in the area of influence of extreme environmental factors. Estimates of work environment factors defined for "hypersensitive" and "hyposensitive" servicemen indicate the objective existence of several ways to adapt to these harmful factors, which are manifested in the conditions of service in the JFO area.

*Psychophysiological changes in the conditions of short-term rehabilitation and treatment.* First of all, it should be noted that no significant difference was found between the results of measuring psychophysiological parameters in servicemen "hypersensitive" and "hyposensitive" to the

**Table 1.** Profiles of sensations of different groups of combatants from the action of factors of the combat environment, the median (*Me*) in c.u.

Indicators	Group 1 (n=12) "hypersensitive"	Group 2 (n=12) "hyposensitive"	Group 3 (n=6) "amorphous"
Reactive shelling of volley fire "Hai", "Hurricane", etc.	68.5 [45-80]***	45.0 [9-55]	13.0 [7-22]
Mortar shelling	56.0 [51-80]***	39.0 [9-55]	13.0 [8-16]
Shelling from a tank	72.0 [58-85]***	40.0 [10-56]	14.5 [8-25]
Artillery shelling	75.5 [65-83]***	39.5 [10-68]	13.5 [9-25]
Sniper shelling	55.5 [46-86]***	42.0 [19-57]	15.0 [8-18]
Fear of direct contact with enemy infantry in the offensive	45.0 [26-67]**	22.0 [3-46]	25.0 [9-57]
Fear of direct contact with enemy infantry in defense	34.0 [20-66]***	10.0 [3-16]	54.0 [9-86]
Constant expectation of possible direct contact with the enemy when performing tasks	57.5 [25-86]***	10.0 [5-35]	47.5 [8-87]
Wounded comrade	30.5 [15-80]*	12.5 [4-47]	37.0 [9-60]
Death of a comrade-in-arms	46.0 [36-81]	38.0 [6-67]	34.0 [9-55]
Fear of injury	33.5 [14-72]**	12.5 [3-21]	25.5 [8-59]
Fear of becoming disabled (as a result of injury)	46.5 [38-80]***	20.0 [3-55]	61.0 [59-66]
Fear of stepping on a mine (stretching)	30.0 [14-65]	27.0 [7-61]	64.5 [62-74]
Fear of hitting a landmine	29.5 [19-60]	17.5 [2-62]	70.0 [59-78]
Fear of being taken prisoner	49.5 [36-89]	12.0 [2-62]	61.0 [54-79]
Uncertainty in the forecasts of commanders, unpredictability of the real development of the situation	45.0 [39-65]***	18.5 [3-36]	57.0 [44-65]
Incompetence of commanders	42.5 [34-58]**	31.5 [6-40]	62.5 [42-81]
Lack of combat training, fighting spirit, colleagues	44.0 [35-57]***	31.0 [7-38]	46.0 [20-67]
Concern about the consequences of personal mistakes (fear of making a mistake, own incompetence)	24.5 [18-72]	37.5 [5-42]	66.5 [18-81]

**Notes:** here and in the following tables, \*, \*\*, \*\*\* - the reliability of the difference between the average values of indicators of group 1 and group 2 on the parameters of harmful factors of the working environment according to the Mann Whitney U-test, respectively, at the level of  $p < 0.05$ ,  $p < 0.01$ ,  $p < 0.001$ . In square brackets the limits of the percentile interval of the used data.

action of environmental factors during treatment. This indicates an approximately identical functional condition of the servicemen who arrived for recovery. However, after 10 days of treatment, the difference in the improvement of functional status begins to appear (Table 3). First of all, there is a significant difference between the characteristics of the lability of nervous processes, which are assessed using the critical frequency of light flicker (CFLF). It has become classic knowledge that an increase in the level of CFLF indicates an increase in the lability of nervous processes and a decrease in the level of human fatigue. In view of this, it can be stated that significantly higher values of CFLF in the group of "hypersensitive" may be evidence of faster recovery of body functions in this group, reducing their fatigue in a relatively short period of rehabilitation procedures.

In addition, it should be noted that the representatives of the discussed group tend to have the best professional qualities in terms of parameters that reflect the level of activity of the body and opportunities to mobilize its reserves (SVMR,  $\sigma$ SVMR), endurance of the nervous system (SNP), concentration of attention (number of processed tasks, time spent), the dynamics of nervous processes (DNP). Although

these changes are not significant, their mass increases the confidence that there are better opportunities to adapt to the harmful factors of the combat environment in this group of "hypersensitive" people. One might think that the high sensitivity to the influence of combat factors allows conditionally "hypersensitive" servicemen to respond more quickly and adequately to the challenges of adverse effects of various harmful factors, rather to adapt to the ongoing transformations of these factors.

*The level of burnout and recovery of emotional state in the short term.* Complex processes occurring in the human psyche can be described not only through self-assessment of the impact on the body of environmental factors, but also with the involvement of self-assessment of symptoms of emotional burnout. The discussed estimates are formed under the influence of various phenomena. In one case, under the influence of certain factors of the work environment, and in the other - in the formation of integrated emotional sensations that reflect the impact on the body of a serviceman complex of stressful situations associated with his professional activities. Therefore, it is important to combine the use of information on selected groups of "hypersensitive" and "hyposensitive" servicemen with

**Table 2.** Characteristics of sensations of different groups of combatants from the action of vital factors, median (*Me*) in c.u.

Indicators	Group 1 (n=12) "hypersensitive"	Group 2 (n=12) "hyposensitive"	Group 3 (n=6) "amorphous"
Accommodation in a dugout	47.0 [29-62]**	37.0 [4-54]	24.5 [7-32]
Accommodation in a tent	60.5 [31-72]***	33.0 [4-44]	32.0 [8-44]
Living in destroyed buildings	52.5 [30-63]**	35.0 [5-53]	29.5 [8-38]
Malnutrition (due to irrational and inconsistent nutrition)	43.5 [36-73]***	7.5 [5-54]	41.0 [8-60]
Prolonged stay in low temperatures	61.0 [40-74]**	31.5 [5-81]	38.5 [9-60]
Prolonged stay in hot conditions	54.0 [35-65]***	31.0 [3-45]	11.0 [6-50]
High humidity, precipitation	37.5 [19-76]	33.5 [4-45]	43.0 [9-60]
Staying in mud underfoot	49.5 [31-72]**	35.0 [5-54]	25.0 [10-55]
Lack of possibility of regular washing	68.0 [42-75]***	31.0 [3-41]	10.0 [8-34]
Lack of opportunity to always wear clean clothes	53.0 [35-72]*	39.0 [3-50]	31.0 [21-85]
Disorders of habitual sleep (duration, continuity)	62.0 [35-75]**	35.0 [2-64]	51.5 [14-62]
Lack of equipment	42.0 [33-65]	36.0 [2-65]	54.0 [12-64]
Comfort of stay in the team (in battle)	51.0 [33-70]	65.5 [2-90]	60.5 [38-67]
Comfort of stay in the team (at home)	63.5 [25-75]	47.5 [1-90]	55.5 [34-66]
Frequent conflicts with commanders	20.5 [12-59]	33.0 [4-42]	25.5 [13-89]
Conflict situations with colleagues	40.0 [5-61]	29.0 [3-43]	26.5 [2-65]
Social isolation: inaccessibility to the media (TV, Internet, press), etc.	29.5 [1-64]**	8.5 [3-27]	45.0 [19-89]
Remoteness and anxiety for loved ones	68.5 [25-75]	43.0 [9-90]	62.0 [37-88]
Quality of medical care (lack of individual first aid kits, etc.)	57.0 [15-79]*	37.5 [9-44]	45.0 [39-89]
Long monotonous work. (monotonous work)	57.5 [48-65]***	34.5 [7-44]	57.5 [47-64]

homogeneous impressions of the action of environmental factors to analyze the characteristics of emotional burnout.

It can be stated that the levels of the obtained scales of emotional burnout in the representatives of both groups did not exceed the critical values on average, and the syndromes that represented these scales, most often we can say that they did not develop. In some groups of servicemen, the values of some scales exceed 9 points, which confirms the conclusion about the formation of the corresponding symptom. Such symptoms in the "stress" phase before and after the start of medical rehabilitation in both groups are not observed. For the "resistance" phase, there is only one symptom ("inadequate selective emotional response"), which is formed in both groups before recovery. The same symptom after recovery is manifested only in the group of "hypersensitive". For the phase of "exhaustion" before the start of medical rehabilitation, there is one symptom ("emotional alienation") for the group of "hypersensitive", which is no longer observed after treatment. In addition, it should be noted that the levels of total indicators that reflect the formation of certain phases of burnout, indicate the non-formation of these phases both before and after the recovery process. However, one symptom undergoes significant changes for the analyzed groups before rehabilitation. This is a symptom of "experiencing traumatic circumstances" ( $p < 0.05$ ). However,

such shifts are observed only at the subthreshold level ( $< 9$ ).

As a result of the analysis of emotional burnout before and after rehabilitation treatment, we can conclude that in both groups there are only some signs of emotional burnout. These symptoms are mostly manifested before treatment, and after treatment remain low in the group of "hypersensitive" servicemen on the symptom of "inadequate selective emotional response", which belongs to the phase of "resistance" (not formed for this group). Since the symptoms of emotional burnout on a number of scales coincide with the symptoms of chronic fatigue, we can assume that these syndromes, in most cases, are inherent in the surveyed contingent of combatants.

*Evaluation of the effectiveness of rehabilitation and treatment measures applied during the 10-day stay of servicemen in the MMCC CR.* Quantitative assessment of the effectiveness of the procedures used is very important to confirm the positive results of rehabilitation treatment. To solve this problem, it is necessary to develop technology to determine the effectiveness of treatment. Since it was found that during the 10-day recovery period, only psychophysiological indicators of servicemen undergo significant changes, it is advisable to use these indicators to assess the effectiveness of treatment. At the first stage of performance evaluation it is necessary to evaluate a set

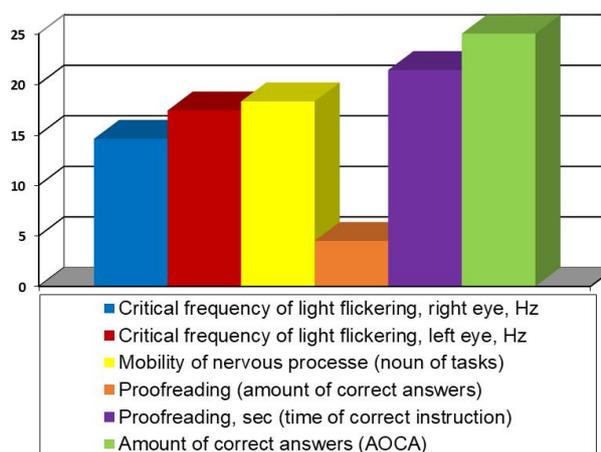
**Table 3.** Features of psychophysiological parameters in persons with "hypersensitivity" and "hyposensitivity" to the action of factors of the working environment, median (Me).

Indicators	Group 1 (n=12) "hypersensitive"	Group 2 (n=12) "hyposensitive"	Group 3 (n=6) "amorphous"
Critical frequency of light flicker r.gr, Hz	46.1 [41.6-52.1]**	41.0 [37.9-46.6]	43.4 [35.4-52.1]
Critical frequency of light flicker l.gr, Hz	47.9 [42.5-50.1]**	42.8 [34.4-48.1]	44.1 [36.4-50.3]
Simple visual-motor reaction, ms	276.1 [254.4-303.6]	293.8 [257.3-357.0]	335.4 [278.3-356.0]
? of simple visual-motor reaction ms	36.5 [19.0-167.1]	60.4 [37.5-77.1]	67.4 [44.3-140.8]
Complex visual-motor reaction, ms	463.2 [356.2-509.5]	450.9 [405.0-511.3]	445.9 [404.0-517.6]
? of complex visual-motor reaction, ms	94.3 [65.2-167.1]	97.5 [62.8-142.0]	72.4 [57.0-107.8]
Errors instructions	4.0 [1.0-7.0]	2.5 [1.0-5.0]	2.5 [1.0-7.0]
Functional mobility of nervous processes, ms	316.5 [233.0-383.0]	315,0 [243.0-387.0]	322.0 [277.0-412.0]
The strength of nervous processes, ms	405.4 [308.8-482.3]	428.3 [323.9-510.6]	417.2 [359.7-477.5]
Number of tasks	192.0 [154.0-246.0]	213.5 [163.0-271.0]	220.0 [206.0-259.0]
Dynamics of nervous processes, c.u.	0.0002 [0.000-0.0031]	0.0001 [0.0001-0.0029]	0.0010 [0.000-0.0033]
Lead time, ms	32.0 [0.0-106.0]	26.5 [0.0-82.0]	9.0 [0.0-199.0]
Delay time, ms	91.5 [54.0-169.0]	83.0 [55.0-133.0]	99.5 [67.0-133.0]
Number of advances	2.0 [0.0-7.0]	2.0 [0.0-5.0]	2.0 [0.0-4.0]
Number of delays	17.0 [12.0-19.0]	17.0 [14.0-19.0]	17.0 [15.0-19.0]
Number of correct marks	23.0 [21.0-25.0]	23.0 [21.0-25.0]	24.0 [21.0-25.0]
Time spent, s	300.0 [186.0-400.0]	318.5 [230.0-408.0]	308.5 [273.0-326.0]
Time of correct answer, s	12.5 [8.0-14.0]	12.0 [10.0-17.0]	11.0 [5.0-20.0]
Wrong answer time, s	9.5 [0.0-25.0]	9.0 [0.0-38.0]	12.0 [2.0-23.0]
Number of correct answers	16.5 [14.0-17.0]	16.0 [14.0-17.0]	16.0 [14.0-17.0]
Number of incorrect answers	2.5 [0.0-4.0]	1.0 [1.0-4.0]	2.0 [1.0-5.0]

of six selected parameters inherent in the entire contingent: CFF r.e., CFF l.e., the number of tasks performed in FMNP testing, the number of correct marks (proofreading), the time of correct indication (proofreading) and the number of true answers (TA). The second stage consists of calculating the effectiveness of treatment according to the following indicators by the formula:  $E=100 \times (|X_{after} - X_{before}|) / X_{before}$  where X is the individual psychophysiological indicator used, current (after rehabilitation) and initial (before rehabilitation) values of relevant psychophysiological parameters. The result will be obtained as a percentage and can be used to assess both the individual effectiveness of rehabilitation and group (by averaging individual information on the effectiveness of recovery).

An example of this assessment (generalized for polar groups) can be performed calculations based on informative psychophysiological indicators, the diagram of which is presented in Figure 3.

The diagram shows that the number of responses (NR), which reflects the level of short-term memorization and reproduction of data, is the most significantly subject to change. The smallest change is observed in the transformation of the number of correct marks (proofreading). The rest of all these psychophysiological



**Fig. 3.** Effectiveness of 10-day recovery of servicemen with chronic fatigue in the Military Medical Clinical Center of the Central Region. On the abscissa axis - informative psychophysiological indicators. On the y-axis - the average effectiveness of the applied therapeutic measures in percent.

variables occupy an intermediate position. On average, for all six parameters, the effectiveness of treatment is

16.7 %, which is a good indicator of short-term recovery. The individual information obtained during the recovery process may be useful to the physician in monitoring the recovery of psychophysiological functions and, if necessary, adjusting the design of treatment measures in the event of deteriorating psychophysiological and/or recovery efficiency. For a psychophysiologicalist, this information will be needed to correct the psychophysiological status of servicemen by training "unprofitable" professionally important qualities. In any case, the work of the doctor and the psychophysiologicalist should be carried out in parallel and in coordination.

### Discussion

Medical and psychological rehabilitation is a set of treatment-and-prophylactic, rehabilitation and health-improving measures of medical and psychological nature, which are aimed at preserving the health of injured servicemen, reducing the frequency and severity of combat mental trauma in the form of post-traumatic stress disorder and chronic psychosis, has preventive, clinical, functional and psychological forms [1, 10].

In the practice of psychophysiological research of servicemen, there is often evidence of a close relationship between well-being, ability to work and various manifestations of mental states, especially emotional instability and impaired combat effectiveness of servicemen, manifested in temporary or chronic disorders of professional and social behavior [6].

Due to methodological and organizational difficulties, the process of restoring professionally important psychophysiological characteristics of employees is studied rather incompletely and superficially. Changes in these functions are mainly studied in the process of professional activity [12]. However, no less important is the question of determining the time and speed of recovery of psychophysiological functions of man according to estimates of the effectiveness of his treatment. These issues are mainly of interest in sports medicine, but such works, as a rule, do not contain quantitative data and are abstract in nature [17]. However, the importance of addressing the dynamics of recovery in the hospital with severe chronic fatigue, especially when working in high-risk conditions, remains relevant.

As a result of our research, we found that the most related to the stress factor "before" the implementation of treatment are six psychophysiological qualities: SNP, number of correct marks, SVMR, number of correct answers, number of tasks, number of delays ( $R_{si}=0.67$ ). The list of informative characteristics indicates the high activity of the body of servicemen, the dependence of endurance of their nervous system, the level of concentration and reliability of activity from the received stress. After treatment, the number of informative psychophysiological indicators decreases significantly, and the strength of the connection with stress increases slightly ( $R_{si}=0.78$ ), which indicates the gradual

restoration of relevant body functions. The level of mobilization of body functions (?SVMR), lability of nervous processes, which indicates the activation of recovery processes, the time of correct indication in the assessment of short-term memory; the dependence of reliability on the level of stress does not disappear.

Emotional characteristics are related to stress ( $R_{si}=0.52$ ). Before treating these relationships, there are three feelings: "self-dissatisfaction", "caged", "emotional and moral disorientation". After treatment, this connection is slightly reduced along with the elimination of the emotion of "self-dissatisfaction", which characterizes the gradual ordering, systematization of the feelings of the combatant, starting with the relationship to himself. The most related to the stress load is the feeling of the impact on the combatant of combat factors and factors of life ( $R_{si}=0.96$ ). There are 18 informative characteristics of the relevant sensations, 50 % of which relate to the factors of the combat environment, and 50 % - to the factors of life.

The division into groups is a constructive technique for determining the characteristics of the presence of servicemen in the zone of influence of extreme environmental factors. Evaluations of work environment factors defined for "hypersensitive" and "hyposensitive" servicemen indicate that there are several ways to adapt to the harmful factors of service in the JFO area.

After a short recovery, significantly higher values of CFLF in the group of "hypersensitive", which is evidence of faster recovery of body functions in this group, reducing their fatigue. In both groups, there are signs of emotional burnout, which are mainly manifested before treatment. After treatment, signs of emotional burnout remain low in the group of "hypersensitive" servicemen on the symptom of "inadequate selective emotional response."

It was found that the average efficiency of 10-day treatment is 16.7 %, which indicates the benefit of restorative procedures. Information technology has been developed that allows to quantify the outcome of treatment, the use of which will allow a meaningful approach to the treatment process, to carry out dynamic control of its results and improve rehabilitation techniques.

### Conclusion

The study examined changes in the psychophysiological status of servicemen with the preconditions for the development of chronic fatigue, one of the characteristics of which is emotional burnout (in the process of its recovery in a hospital). The presence of effective changes in a number of psychophysiological functions in 10 days after admission of the serviceman to the hospital is shown. The evaluation of the effectiveness of treatment and the planned mechanisms for its increase are carried out. It has been proven that even a weak emotional burnout cannot be overcome in a short period of time. Therefore, for a quality recovery of professionally important human functions need to plan a longer period.

## References

- [1] Bakker, A. B., Schaufeli, W. B., Leiter, M. P., & Taris, T. W. (2008). Work engagement: An emerging concept in occupational health psychology. *Work & stress*, 22(3), 187-200. doi: 10.1080/02678370802393649
- [2] Belynskiy, A. V. (2000). *Современные подходы к медицинской реабилитации военнослужащих с пограничными психическими расстройствами [Modern approaches to medical rehabilitation of servicemen with borderline mental disorders]*. Военно-медицинский журнал - Military Medical Journal, 321(8), 25-34.
- [3] Boiko, V. V. (2008). Синдром эмоционального выгорания: диагностика и профилактика [Burnout syndrome: diagnosis and prevention]. СПб: Питер - SPB: Peter.
- [4] Compas, B. E., Forsythe, C. J., & Wagner, B. M. (1988). Consistency and variability in causal attributions and coping with stress. *Cognitive therapy and research*, 12(3), 305-320. doi: 10.1007/BF01176192
- [5] Glebov, V. H. (2005). Психологическая адаптация военнослужащих к служебно-боевой деятельности в условиях вооруженного конфликта [Psychological adaptation of military personnel to service and combat activities in an armed conflict]. *Ориентир - Oriyentir*, (112), 36-39.
- [6] Glushko, A. N. (1998). Психофизиологические основы психогигиены и психопрофилактики [Psychophysiological foundations of psychohygiene and psychoprophylaxis]. *Военно-медицинский журнал - Military Medical Journal*, (1), 63-70.
- [7] Kalynsh, V. V., & Maltsev O. V. (2020). Вплив психотравмуючих чинників зовнішнього середовища на переживання комбатантів, служба яких проходила в умовах бойових дій [Influence of psycho-traumatic environmental factors on the experiences of combatants whose service took place in combat]. *Український медичний часопис - Ukrainian Medical Journal*, 5(2 (139)), 27-30. doi: 10.32471/umj.1680-3051.139.191218
- [8] Kalynsh, V. V., Pyshnov, H. Yu., & Varyvonchuk, D. V. (2016). Актуальні проблеми психофізіологічного стану учасників бойових дій [Actual problems of psychophysiological condition of participants in hostilities]. *Україна. Здоров'я нації - Ukraine. Health of the nation*, (4 (1)), 37-43.
- [9] Kochyna, M. L., & Fyrsov, A. H. (2010). Многофункциональный прибор для проведения психофизиологических исследований [Multifunctional device for psychophysiological research]. *Прикладная радиоэлектроника - Applied radio electronics*, 9(2), 260-265.
- [10] Kokun, O. M., Ahaiev, N. A., Pishko, I. O., Lozinska, N. S., & Ostapchuk, V. V. (2017). *Психологічна робота з військовослужбовцями-учасниками АТО на етапі відновлення: Методичний посібник [Psychological work with servicemen-participants of anti-terrorist operation at the stage of recovery: Methodical manual]*. К.: НДЦ ГП ЗСУ - К.: Research Center for Humanitarian Problems of the Armed Forces of Ukraine.
- [11] Lunev, R. S., & Lunev, D. S. (2014). Психофизиологическое восприятие в профессиональной деятельности человека (на примере государственной работы сотрудников пограничной службы Российской Федерации) [Psychophysiological perception in a person's professional activity (on the example of the state work of employees of the border service of the Russian Federation)]. *Вестник психофизиологии - Bulletin of psychophysiology*, (4), 19-26.
- [12] Maslov, N. B., Bloshchynskiy, Y. A., Galushkyna, E. A., & Rohovanov, D. Yu. (2012). Концептуальные подходы к оценке функционального состояния специалистов в процессе их профессиональной деятельности [Conceptual approaches to assessing the functional state of specialists in the process of their professional activities]. *Экология человека - Human ecology*, (4), 16-24.
- [13] Melamed, S., Ben-Avi, I., Luz, J., & Green, M. S. (1995). Objective and subjective work monotony: effects on job satisfaction, psychological distress, and absenteeism in blue-collar workers. *Journal of Applied Psychology*, 80(1), 29-42. doi: 10.1037/0021-9010.80.1.29
- [14] Pashkyn, S. B., & Kverevkyna, D. H. (2013). *Психические познавательные процессы в условиях служебной деятельности [Mental cognitive processes in the working environment]*. СПб: ВИ(ИТ) - SPb: VI (IT).
- [15] Popeliushko, R. P. (2015). Особливості психологічної реабілітації учасників бойових дій засобами природничої рекреації [Features of psychological rehabilitation of combatants by means of natural recreation]. *Актуальні проблеми психології - Current issues of psychology*, XI(13), 198-205.
- [16] Quick, J. D., Nelson, D. L., Matuszek, P. A., Whittington, J. L., & Quick, J. C. (1996). *Social support, secure attachments, and health. Handbook of Stress, Medicine and Health / ed. C. Cooper*. Boca Raton, FL.
- [17] Solodkov, A. S. (2013). Особенности утомления и восстановления спортсменов [Features of fatigue and recovery in athletes]. *Ученые записки университета им. ПФ Лесгафта - Scientific notes of the PF Lesgaft University*, (6 (100)), 131-143.
- [18] Topol, O. V. (2015). Соціально-психологічна реабілітація учасників антитерористичної операції [Socio-psychological rehabilitation of participants in the anti-terrorist operation]. Вісник Чернігівського національного педагогічного університету. Серія: Педагогічні науки - *Bulletin of Chernihiv National Pedagogical University. Series: Pedagogical sciences*, (124), 230-233.
- [19] Trinka, I. S., Kalynsh, V. V., Shvets, A. V., & Maltsev, O. V. (2016). Особливості впливу чинників бойового середовища на військовослужбовців [Features of the influence of combat environment factors on servicemen]. *Військова медицина України - Military medicine of Ukraine*, 16(2), 84-94.