

THE DYNAMICS OF THE STATE OF COMPLIANCE WITH PROFESSIONAL REQUIREMENTS FOR THE FULFILLMENT OF THE WORK OF INCREASED DANGER OF THE WORKERS OF THE STATE MILITARIZED MINE RESCUE SERVICE IN THE COAL INDUSTRY OF UKRAINE

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Introduction. Specific working conditions of the mine rescuers of the State militarized mine rescue service in the coal industry of Ukraine (SMMRS) are formed under the influence of the immediate combined effect of hazardous factors of emergency situations, or indirectly during work on duty under the continuous expectation of the alarm signal. The ultra-high level of neuropsychic tension in such conditions requires in-depth studies of compliance with certain professional requirements for the performance of the work of increased danger of SMMRS workers.

The purpose of the study is to determine the dynamics of the state of compliance with professional requirements for the performance of the work of increased risk of SMMRS workers according to psychophysiological examination and according to the results of industrial research of professionally important qualities.

Materials and methods of research. A study of the state of psycho-physiological functions from the SMMRS workers was conducted. The analysis includes materials analysis of indicators of psychophysiological examination conducted by an accredited laboratory, and the results of production studies of the psychological and physiological organism's functions of the SMMRS workers (67 people) who worked on 12-hour day and night duty.

Results. It was found that the psychophysiological indicators of the mine rescuers were not significantly distinguished during the study period, remaining at a rather high level of professionally important qualities. The average duration of the «individual minute» at the beginning of the 12-hour duty amounted to (60.6 ± 1.72) s, and at the end of (60.0 ± 1.68) s, with a physiological norm of (56.8 ± 1.76) s, which indicates a rather high level of already formed adaptation abilities.

Conclusions. The dynamics of the indicators of the psychophysiological assessment of the professionally important qualities of the mine rescuers indicates their consistently high level. This indicates compliance of the level of adaptive abilities of the personal composition of militarized mine rescue teams with professional requirements for the performance of increased danger. Decrease in individual indicators of professionally important qualities does not reduce their overall assessment due to the proper level of other studied psychophysiological indicators.

Key words: mine rescuers, coal industry, psychophysiological examination of professionally important qualities, working conditions

Introduction

Specific working conditions of the mine rescuers of the State militarized mine rescue service in the coal industry of Ukraine (SMMRS) are formed under the influence of the immediate combined effect of hazardous factors of emergency situations, or indirectly during work on duty under the continuous expectation of the alarm signal. The ultra-high level of neuropsychic tension in such conditions requires in-depth studies of compliance with certain professional requirements for the performance of the work of increased danger of SMMRS workers.

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Materials and methods of research

The analysis of indicators of the psychophysiological examination was carried out based on the results of examination of personnel of the paramilitary mine rescue detachment with the deployment in Mirnograd, Donetsk region of 15 people in 2015 aged from 26 to 52 years (the average age was (39.6 ± 1.97) years), and 16 people in 2016 aged from 24 to 53 years (the average age was (39.2 ± 2.08) years). The examination of workers was performed by a laboratory accredited for this type of research.

In addition, a complex production study of psychological and physiological functions of body of the detachment personnel was conducted. One of the indicators chosen for analysis in the study was «accuracy of time interval measurement» or «individual sense of time» for a given time interval of one minute. The study was con-

ducted using a stopwatch before and after a 12-hour duty. Thirty-six persons, aged 23 to 54 years (the average age was (38.0 ± 1.34) years), were examined.

In the protocols of psycho-physiological examination for the type of work «Emergency rescue work and firefighting work» the following indicators were evaluated [5]:

- sensorimotor reactions (techniques of simple and complex sensorimotor reactions, for evaluation of psychodynamic properties);
- attention (the technique «Table» with identification of numbers from 1 to 99 in ascending order, to evaluate selectivity, distribution and steadfastness of attention);
- attention switching speed (the «Attention Switching» technique, with sequential identification of the smallest/largest number between two differently colored tables, to assess the distribution and switching of attention);
- emotional stability and anxiety (the «Individual Sense of Time» technique, with subjective evaluation of the time period at the end of a given time interval, to determine the individual minute and calculated index of adaptability, which allows finding out the level of tension and synchronization of body systems);
- stress-resistance (the «Extreme conditions» technique, with finding a pattern in the location of signs for a certain time with a gradual increase in the level of difficulty, to determine the specific features and performance of the thinking process under psycho-emotional tension, which allows to predict the reliability of professional activity under stress);
- fatigue (the «Functional Nervous Process Mobility» technique, with reaction to stimulus presentation in the form of figures and feedback on the correctness of the answer, for determining the speed of the processes of activation and inhibition);

- spatial orientation (the «Clocks» technique with assessment of the position of the hour and minute hands of dials with only one numerical marker, to determine individual perception of spatial relations and imaginary operations with visual images, as important elements of cognitive processes);
- reaction to an object that moves (the «Pendulum» technique with reaction to the combination of a dynamic marker (a swinging pendulum) and a static marker (a stationary point on the horizontal axis), to assess the balance of nervous processes when the level of activation in the central nervous system increases or decreases;
- decision-making and action ability in extreme conditions (method «formalized observation assessments» with fixing the time of occurrence of vegetative and psychomotor or emotional manifestations (behavior, concentration and conscientiousness) and degree of their expression at the beginning or at the end of work, to assess emotional stability and anxiety, resistance to stress, decision-making and action ability in extreme conditions.

The analysis was carried out using the variation statistics methods with calculation of average values and their standard errors, using statistical software package «STATISTICA» 7,0 and Microsoft Excel application to the licensed software package Office 2016. Significance of differences between comparison groups was assessed by Student's t-criterion.

Results of research and discussion

There has been carried out the analysis of test indicators of psychophysiological examination of professionally important qualities of mine rescuers who underwent the examination to determine

their own abilities to perform work of increased danger.

According to the data obtained, psychophysiological indicators of mine rescuers during the study period did not differ significantly, remaining at a sufficiently high level of professionally important qualities (more than 45 points) (see the Figure). And the average value of almost all indicators was determined more than 50 points, except for indicators of sensorimotor reactions, and several average indicators of the following year were above 55 points, namely: the reaction to a moving object, the ability to take decisions and actions in extreme conditions, speed of switching attention.

However, with the average high level of professionally important qualities, in some rescuers there was a decrease in individual indicators (see the Table), which in general did not worsen the overall assessment due to the appropriate level of other psychophysiological indicators on the principle of an integrated approach in the assessment of professionally important qualities.

This approach takes into account the peculiarities of compensation of individual professionally important qualities and functions, their interrelation, variability and dynamism, which determines the possibilities of individual adaptation to a particular work activity [6].

In general, the greatest difficulties while solving test tasks occurred in the study of sensorimotor reactions and the ability to take decisions and actions in extreme conditions. However, according to A. I. Yena with co-authors, the above-mentioned indicators are not the highest priority for rescue and firefighting operations, that is the type of work for which psychophysiological examination of professionally important qualities of mine rescuers is conducted. According to the authors, the most significant indicator influencing the forecasting

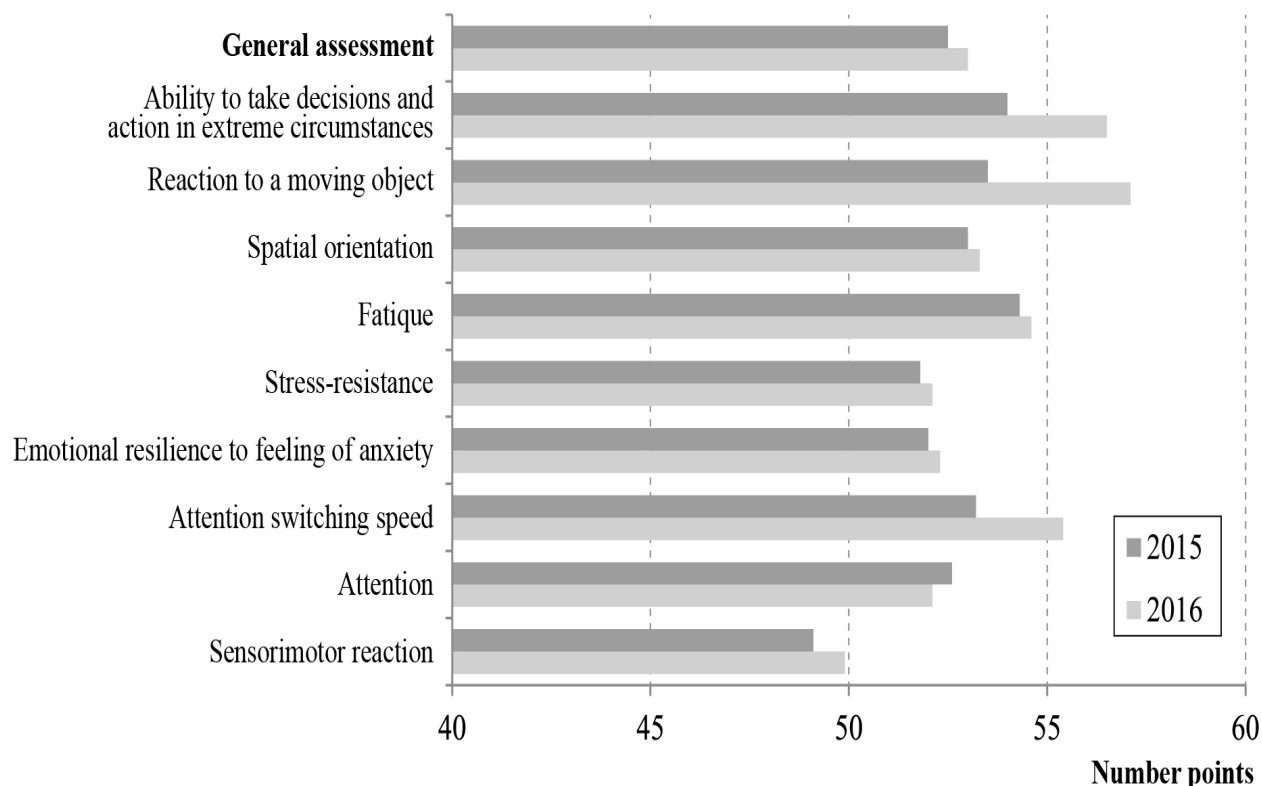


Figure. Average indicators of professionally important qualities of mine rescuers according to psychophysiological examination during two years of observation

of successful adaptation to the execution of works of increased danger of this type is the fatigue index, that is, the rate of flow of activation and inhibition of physiological processes [7]. This index is critically important for performing all other hazardous jobs, because increased sensitivity to standard workloads, rapid development of fatigue and slow recovery after exposure to negative production factors testify to insufficient professional suitability [8–10].

Besides, one of the important indicators of professionally important qualities is the subjective sense of time, which is estimated by the duration of individual minute, which correlates

with the changes in the somato-vegetative indicators and therefore can be used as one of the criteria for evaluating the quality of adaptation of the body to various environmental conditions [11, 12]. The index of the individual minute reflects the psychophysiological state of the organism and its value is proportional to the degree of emotional tension [13]. In the formation of adaptive changes under the influence of acute stress, subjective time is sharply accelerated, the metric time is stretched, it is associated with adaptive reactions and the need to respond quickly, that is, over shorter metric time more information to make a vital decision is considered. And on the contrary, in poorly adapted

Table

**Presence of reduced psychophysiological indicators of psychophysiological examination
in mine rescuers over two years (percentage), %**

| Indicator of professionally important qualities | Year of the psychophysiological assessment | |
|---|--|------|
| | 2015 | 2016 |
| General assessment | – | – |
| Ability to take decisions and action in extreme circumstances | 2 | 1 |
| Reaction to a moving object | – | 1 |
| Spatial orientation | – | 1 |
| Fatigue | 1 | – |
| Stress-resistance | – | – |
| Emotional resilience to feelings of anxiety | – | – |
| Attention switching speed | 1 | – |
| Attention | – | 2 |
| Sensorimotor reactions | 1 | 2 |
| Total number of reduced psychophysiological indicators, % | 5 | 7 |

people subjective time is either near the metric or slows down, which indicates "failure of adaptation" and inability to react adequately (i.e. inability to process the amount of information in a certain time that is necessary to ensure the vital activity of the organism) [14].

When assessing the results of duration of mine rescuers' individual minute while on duty, the indicators did not differ significantly. The average duration of individual minute at the beginning of duty was (60.6 ± 1.72) s, and at the end (60.0 ± 1.68) s, which indicates a sufficient

level of already formed adaptive abilities, as in people who adapt well, individual minute exceeds the minute of real time (from 58–70 to 85 s) [15], with a physiological norm (56.8 ± 1.76) s [16].

The results indicate a consistently high level of professionally important psychophysiological qualities of mine rescuers. This can be explained by the fact that this contingent has higher requirements for professional selection of command and regular staff, as well as that they are experiencing the influence of «spontaneous»

selection, when those people who are not able (either for health reasons, or work efficiency) to meet all the requirements leave the profession.

Conclusions

1. Dynamics of psychophysiological examination test indexes of professionally important qualities of mine rescuers has pointed to their high level, which quite corresponds to professional

requirements to execution of increased danger works.

2. Decrease in separate indexes of professionally important qualities doesn't worsen general estimation due to the proper level of other psychophysiological indexes.
3. Level of tension and synchronization of body systems due to the duration of «an individual minute» indicates a sufficient level of already formed adaptive abilities of mine rescuers.

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