

PSYCHOPHYSIOLOGIC ASPECTS OF THE PROBLEM OF PIRATES ACTIVITY IN THE WORLD OCEAN AS A KIND OF HUMANITARIAN CRISIS

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Abstract

Background. The profession of seafarer is linked with the contact of many dangerous occupational and ecological factors, which are harmful to seaman's health and life.

Objective. To analyze areas of constant pirate attacks are similar in their social, economic, psychological and medical components to other humanitarian disasters.

Materials and methods. The studies are undertaken on the base of Odessa National Marine Academy (ONMA) and Marine Training Center for seamen, who were passing sequencing employments and reattestation (58 persons, of whom 37 worked in hazardous areas for pirate attacks), students of the ONMA of correspondence form of education (CFE) - 43 persons, of whom 32 worked in hazardous areas pirate attacks, and students of full-time form of education (FTFE) - 89 persons (36 – after trips in hazardous areas), during simulator preparation and handing over of examinations. The survey and interviews were also conducted with 58 family members of seamen working in hazardous areas (mainly mothers and wives). A control group was made by the seamen of port fleet (32 persons) with zero risk of pirate attacks.

Results. Conducted interviews and questionnaires of seamen and cadets, who had returned from trips to the hazardous of pirate attacks areas, did not reveal significant changes in their psychophysiological status. This was also confirmed by data execution of psychological tests.

Conclusions.

1. In the complication due to the situation on the sea routes associated with the risk of international terrorism and piracy on the high seas significantly increases the importance of seaman's psychophysiological status and the readiness for an adequate response and concerted action in emergencies.
2. Psychophysiological basis while developing overcome psychoemotional stress is a system of individual and personal qualities, which manifests itself as integrally degree of stability to stress and provides an adequate response in terms of danger and reflection pirate attacks.
3. Stress level can be effectively decrease with the help of psychophysiological training, autotraining and other form of psychoemotional status management, as well as preventive and rehabilitative measures against depression, anxiety, fatigue and other posttraumatic stress disorders. Such methods can be successfully used as a purpose, i.e. before, during and after the emergent situation.

Key words: psychophysiologic aspects; pirates; activity; world ocean; humanitarian crisis.

The profession of seafarer is linked with the contact of many dangerous occupational and ecological factors, which are harmful to seaman's health and life [1-3]. For the last decades to this list was added another one, well-known from the antiquity factor, that had risen its apogee in XVII- XVIII centuries, but that has been forgotten at the recent time, that is piracy on the sea-lanes in the different regions of the World ocean. It is necessary to underline that piracy in modern terms is one of the numerous types of international terrorism that is a global problem for all world community [4, 5]. In this connection it should be recalled that for more than five years, the world is shaken by the order of 36 armed conflicts that take place in 26 countries [6, 7], unfortunately, not excluding the Ukraine. Therefore, areas of constant pirate attacks are similar in their social, economic, psychological and medical components to other humanitarian disasters. Seamen, who work in these areas, and their families are exposed to intensive psycho-emotional impact (psychological distress). They need a psychophysiological support, and sometimes - medical and psychological rehabilitation.

1. Statistic Data

For the study of matter-position and development of preventive measures the International Marine Bureau (IMB) of the International Chamber of Commerce (ICC) created an informative center on marine piracy (Piracy Reporting Centre - PRC) in 1991, that publishes annual reports about terrorists' attacks on the ships.

According to the published by the IMB reports from 1991 to 2011 pirate activity on sea ways was very high (Fig. 1). Due to the influence of the international community this activity tends to educe in 2010-2013. But the problem has not lost its relevance. As early as in May of 2013, it was reported the capture of a merchant ship with 17 Ukrainian seamen in the port of Benghazi (Libya). Such examples are enough to explore the issue at the UN level. It is reflected in the proposals of the United Nations Interregional Crime and Justice Research Institute (UNICRI), which developed an initiative

related to the use of private security contractors on board of commercial vessels with a view to the safe passage in the areas of most dangerous by pirates' attacks (for example, near the Somalia coast).

Regularly published data convincingly show the value of this factor for safety of seagoing ships, as the pirates' attacks accepted as constant operating dangerous factor on sea-lanes. And although for the last three years a tendency was set to the decline of number of cases of capture of courts in the most dangerous districts of the World Ocean, first of all, at banks the African horn, a problem hasn't lost the actuality.

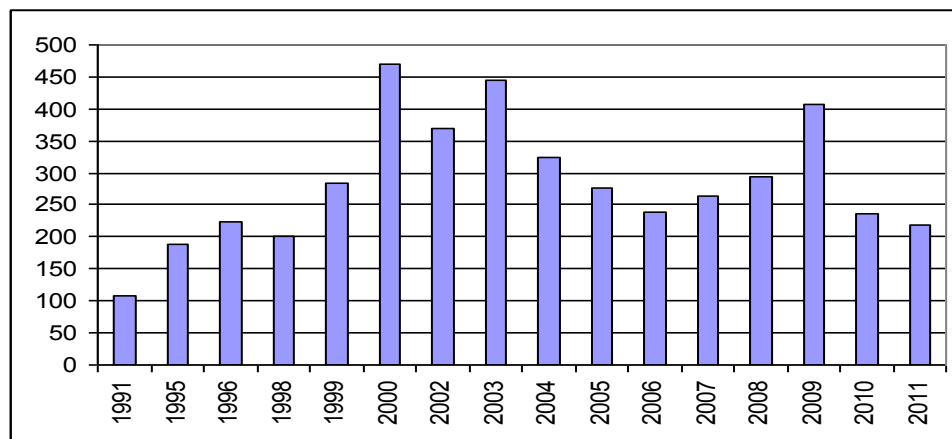


Fig. 1. Dynamics of number of cases of pirates' attacks on ships (According to the reports of IMB) [8]

2. Piracy and risks for a health and life of seamen

Mostly the members of ships' crews of maritime transport become the victims of pirates' attacks ships that come forward as hostages and captives of terrorists with a credible threat for a health and life become the target of such attacks, the cases of attacks are although known and on passenger ships. Such risks can be illustrated by the data collected in table 1.

From the given data in the table evidently is seen that by an amount of captives by the Somali pirates, 2010 became a record year. There were captured 1181 members of crews. In 2011 there were 439 piratic attacks and 45 trade courts driven away in the whole world. 237 from these attacks and 28 from these driving away happened in the Aden Bay, at banks of Somalia, and in the vast zone of the Indian Ocean.

Table 1. Quantitative descriptions of types of violence and risks for health and life of seamen because of pirates' attacks on ships [9]

Type of violence	Years				
	2006	2007	2008	2009	2010
Androlepsy	188	292	889	1052	1181
Kidnapping	77	63	42	12	20
Armed attack on the ship	2	29	7	4	6
Injured crew members	15	35	32	68	37
Murders of crew members	15	5	11	8	8

In 2013, as IMB's global data showed, pirates hijacked 10 vessels, fired at 17, and boarded 140. A further 21 attacks were thwarted. In total 266 crew were taken hostage and 34 kidnapped. One seafarer was killed, twenty were injured, and one is reported missing. The Somali pirates presently use the driven away ships as a base float for the attacks in the north of the Arabian Sea and at the coast of India, for more than for 1500 miles from Somalia.

If earlier linear ships, containerships and "ro-ro" in connection with their high-speed and in high free-board had been rarely exposed to the attacks, then presently situation substantially became worse [10]. In 2010 32 liners were attacked, and six among them were captured. In 2011 65 liners were attacked and one was driven away by pirates. Such facts and statistics have continuation in 2012-2013. So, in 2012 297 ships attacks was accomplished, 28 courts and 585 members of crews were trapped, 6 seamen perished and 32 got wounds and traumas among them. Thus, piracy still remains an important problem complicating an ocean and marine navigation.

3. Psychophysiological reactions of seamen at the threat of pirates' attacks

Pirate attacks have to be examined as one of the types of emergency situations (ES). In a general terms, such situation may occur as a result of an accident, natural disaster or other causes. All of them, as a rule, lead to the states of mental and emotional stress, like victims and persons involved in of the emergency situation liquidation [11, 12]. If emergencies are common signs of the presence of threat for human health and life, as well as considerable material damage, then the most essential elements of human reaction in such situations are changes of psycho-emotional status. Unlike refugees and persons affected by regional humanitarian crisis zones, mariners should continue to work on the ship, confront occupational stress and show psychophysiological readiness to the actions in non-standard situations and communicability as a basis for the collective opposition to the terrorists.

Given the above, *the purpose of this study was* to develop a system of psycho-physiological training of seafarers to adequately reacting, and increasing of resistance to stress under the risk of pirate attacks and terrorism in the World Ocean.

4. Materials and methods

The studies are undertaken on the base of Odessa National Marine Academy (ONMA) and Marine Training Center for seamen, who were passing sequencing employments and reattestation (58 persons, of whom 37 worked in hazardous areas for pirate attacks), students of the ONMA of correspondence form of education (CFE) - 43 persons, of whom 32 worked in hazardous areas pirate attacks, and students of full-time form of education (FTFE) - 89 persons (36 – after trips in hazardous areas), during simulator preparation and handing over of examinations. The survey and interviews were also conducted with 58 family members of seamen working in hazardous areas (mainly mothers and wives). A control group was made by the seamen of port fleet (32 persons) with zero risk of pirate attacks.

For the stressful situations were accepted: working off on a simulator of intricate navigation problems and handing over of examinations. All seafarers and cadets internal and correspondence departments surveyed three times: outside the classroom (seamen - after returning from a trip), as well as before and after implementation of corresponding tasks.

Psychophysiological methods included an investigations on a computer-assisted complex "MORTEST" [13] (tests: random access memory (RAM), common analogies on the verbal thinking (VT), reaction on the moving object (RMO), mobility of nervous processes or complex sensomotor reaction (CSMR), tests of 'Tangled lines' (IL), Lusher, Schulte (TS), Raven (TR)); implementation of form tests of Eizenk, Benton, "Landolt Rings", "State of Feeling-Mood-Activity" (FMA), anxiety by Spielberg-Hanin (ASH) and Taylor (AT) [14, 15]. Materials of researches were processed by means of methods of variation, cross-correlation and factor analysis on the standard program in Microsoft Excel [16, 17].

5. Results of psychophysiological researches

Conducted interviews and questionnaires of seamen and cadets, who had returned from trips to the hazardous of pirate attacks areas, did not reveal significant changes in their psychophysiological status. This was also confirmed by data execution of psychological tests. However, a detailed analysis revealed that the level of neuroticism on the test of Eysenck was significantly higher ($p < 0,05$) in the exposed group of respondents, than in control and similar groups of crew members, working in non-hazardous areas (in seafarers it noted in 45 % of people working in hazardous areas, in cadets - almost 60 % of cases (control - in 15.6 %). These parameters correlated with the results of evaluation of test anxiety by Taylor ($r = 0,78$, $p < 0,01$) in the main group at $r = 0,26$ have not experienced pirate attacks associated with stress. With anxiety by the test Lusher no significant correlations to test Eysenck, nor by the test of Taylor, were found. The third index that was a clear indicator of mood decrease to FMA test (in seamen it was in 13.5 % and 36 % of the students) after the trip in areas disadvantaged by pirate attacks. There are substantial differences in the priority issues that prevail in the area surveyed attention immediately upon his return from the trip (1-2 weeks) and after a period of readaptation and spontaneous rehabilitation. In the first case, 56,5 % of respondents dominated psychosocial and economic issues, while the second - medical and psychological (44,9 %). For some students slip

doubts about their chosen profession. And only family members at all stages the main issues are psychosomatic health of seafarers (72,4 %) and, to a lesser extent (36,2 %) - own health.

Observations of the first phase led to an important conclusion: 1. Intensity of stress, cause a dangerous pirate attacks, does not reflect the degree of objective danger, but an appropriate mood, i.e. severity of psychophysiological state changes and manifestations of subjective evaluation. It is expressed primarily and preferably in terms of mood, anxiety and neurotism. 2. The factor of time plays a leading role in the manifestations of the reaction to the danger of pirate attacks: stress indicators are directly dependent on the timing of the return from sea voyages.

Later on, since all surveyed seafarers performed physiological tests in dynamics, usually before and after appropriate (model) of stress load, it was interesting to compare baseline in representatives of different groups of seamen and students to answer questions about how to evaluate their initial psychophysiological status and how these groups are comparable in their functional state out of the action of stressors. The results of this comparative analysis are shown in Table 2.

Table 2

Results of initial testing of seamen and marine students on the "MORTEST" program

Tested group	tests (sum of points)				
	RAM	RMO	CSMR	VT	Average point
Control	7,49 ± 0,29	6,16 ± 0,29	6,38 ± 0,33	6,09 ± 0,24	6,53 ± 0,37
Students of CFE	7,65 ± 0,41	6,50 ± 0,55	6,89 ± 0,37	6,75 ± 0,47	6,95 ± 0,42
Students of FTFE	7,52 ± 0,54	7,38 ± 0,42*	7,42 ± 0,60	6,99 ± 0,32	7,33 ± 0,37
Seamen	7,90 ± 0,18	7,00 ± 0,43	7,44 ± 0,37*	7,25 ± 0,34*	7,40 ± 0,38

Note: abbreviations – see in the text; */ - p < 0,05

As it is evident from the data presented in the table, the most valued indicators results in representatives of the compared groups do not differ significantly. This applies to almost all the main elements characterizing the psychophysiological status of the seaman. Not by chance, a difference between the highest and the lowest average points in the groups was 0,45 point, and in comparison to control also less than one point. Concerning to individual statistically reliable differences, for the students of stationary (full-time) form of education simple sensomotor reactions (RMO test) were substantially higher, than for the representatives of other groups. This can be explained by their permanent work with a personal computer that essentially carries training character. The representatives of seafarers (seamen who are constantly working with navigation equipment, adequate full-scale simulator), also showed significantly higher scores. All this allows considering that the surveyed seamen have been in the relatively quiet initial psychophysiological state that should provide an adequate response in the conditions of occupational stress modeling.

As a result of the correlation analysis of the data obtained revealed significant relationship between the individual - typological and emotionally - personal characteristics surveyed seamen, on the one hand, and their reactions to acute stress, on the other. Thus, a close relationship the number of "organic" error (on the test Benton) with exponent nonverbal thinking (Raven test execution time), on the one hand ($r = 0,46$, $p < 0,01$), and focusing of attention (Schulte - Psyadlo test), the other ($r = 0,39$, $p < 0,05$). This mainly reflects not to the level of individual psychophysiological functions activation, but to the integrated evidence of the influence of individually - typological features of the success of the occupational task performance and the general stress resistance. Important role of the visual analyzer in the assessment and reducing uncertainty of occupationally significant stress manifests itself in high sensitivity and liability of operating visual memory. Among the supposed errors encountered rough (or "organic"), which have a core group during the test Benton (in the state and after acute stress) reach $2,62 \pm 0,27$ cases. This is evidenced also by revealed the relationship of the number of errors on the test Benton with such indicators of Luscher test as deviation from the autogenously norm, the level of conflict, the exponent of mental stress ($r = 0,29$, $p < 0,05$; $r = 0,42$, $p < 0,001$; $r = 0,38$, $p < 0,01$, respectively). In situations requiring human effort to implement specific targeted action, as in this

case, the successful implementation of occupational tasks, the deterioration of these indicators shows a decline in psychoemotional stress and motivation.

Occupationally important qualities (OIQ) of specialist, including the stress resistance, are manifesting in the working activity [18, 19]. Because, despite its individual style, thanks to the a working dynamic stereotype (VDS) formation such activity takes an integrated, predominantly nonspecific, character. Modeling of the main operators' working operations in the simulator allows to evaluate the readiness to this kind of activity (including the reaction to the stressors action in extreme situations) and to implement corrective training. Simulator training proved a kind of "functional test", which allows to identify more clearly the positive physiological changes in the seaman's psychoemotional status (Table 3). The following table summarizes the aggregate for all groups (seafarers and cadets), because the problem was solved to estimate the direction and intensity of the changes on the basic blocks of psychophysiological functions (sensomotor, cognitive, psychoemotional), involved in the OIQ formation.

It is evident from the data presented in the table that in the beginning of the training cycle the necessity of implementation of intricate navigation problems in the conditions of time limit gives the educational and training activities a stress character.

Table 3

Comparison of results of assessment of the dynamics of psycho-physiological status of the seamen and cadets in the simulation of stress (the simulator training), n = 190

Tests and indexes	At the beginning of training	Upon the cycle termination	Differences, %
	M±m	M±m	
Test CSMR, % of errors	9,14 ± 0,55	8,34 ± 0,32	- 9,6
Test RAM, signs	7,26 ± 0,14	7,48 ± 0,13	3,0
Test VT, correct, %	65,42 ± 3,15	73,21 ± 3,03	11,9*
Test VT, time, s	278,42 ± 11,06	247,71 ± 9,44	- 12,4**
Test Shulte-Psyadlo, time, s	56,09 ± 2,04	48,56 ± 2,16	15,5***
Test Shulte-Psyadlo, errors	0,81 ± 0,08	0,66 ± 0,06	- 22,7*
Test "Entangled lines", time, s	138,46 ± 3,86	124,51 ± 3,52	- 10,8***
Test "Entangled lines", errors	1,64 ± 0,20	1,12 ± 0,17	- 31,7**
Test "Reaction on a moving object"			
Temper, %	63,46 ± 4,33	77,05 ± 4,71	21,4**
Total error, degree	186,32 ± 8,75	149,91 ± 10,5	- 19,5***
Exactness, %	52,19 ± 2,31	59,34 ± 2,67	13,7**
Test of Lusher			
Psychoemotional status	16,86 ± 0,53	19,05 ± 0,72	13,0**
Vegetative coefficient	1,28 ± 0,07	1,09 ± 0,05	- 14,8**
Deviation from an autogenic norm	15,96 ± 0,76	13,62 ± 1,03	- 14,7*
Psychical fatigue	4,72 ± 0,28	4,19 ± 0,34	- 11,2
Anxiety	4,55 ± 0,31	3,48 ± 0,41	- 23,5**
Emotional stress	3,48 ± 0,15	3,03 ± 0,16	- 12,2
Capacity	13,52 ± 0,38	14,07 ± 0,47	4,1
Level of alarm	1,47 ± 0,11	1,12 ± 0,08	- 23,8***

Notes: * - is a tendency; ** - p < 0,05; *** - p < 0,001.

The presented in the table data shows that in the beginning of the training cycle the need to perform complex navigation tasks under time limit attached to the stress by the character training activity. It mostly affects indexes of function of attention and in psychoemotional sphere (increased anxiety level, the prevalence of epinephrine like response to a specific type of navigation situations, emotional stress and a rapid decline in health with signs of psychological fatigue).

Testing of plans and obtain the relevant certificate at the end of the cycle classes accompanied by a significant change in the psychophysiological status of the surveyed seafarers and cadets, as evidenced in the table exist benchmarking results psycho-physiological functions (with respect to the first survey). In 68.4% of cases the changes were statistically significant, and the absolute difference values of indicators reached 20-30%.

The data show the informativity of the results of dynamic researches in modeling of occupationally activity and point to the possibility to use the simulator practice not only to enhance the professional knowledge and competence level of ship operators, but as an effective method of increasing the stress of seafarers (psychophysiological training), including the cases of working in the dangerous on pirates attacks regions of the World Ocean.

It is necessary to take in consideration the presence of the existence of differences in the degree of OIQ activation depending on the type of the highest nervous system, that provides adequacy of reacting on the stress loading including the cases of emergency situations.

The study of one of the most important and occupationally significant qualities of seaman - a stress resistance also allows to estimate the degree of his readiness to the actions in emergency situations and, if necessary, to manage it by realization of training and corrective facilities manage them through training and corrective means [20]. One of the effective ways to obtain the necessary in this regard information can be dynamic psychophysiological studies of stress, for example, in terms of exam stress and simulator training.

On the Fig. 2 are shown the results of the test "Landolt Rings" made by seamen with varying degrees of stress in preparation for the exam after cycle training sessions on a full-scale radar simulator. From the presented data it is distinctly seen that practically on all estimated indexes (every minutes productivity – A, speed of information processing - S, volume of the processed information - V, the number of errors - n) is traced the clear dependence on the degree of the surveyed seamen stress resistance.

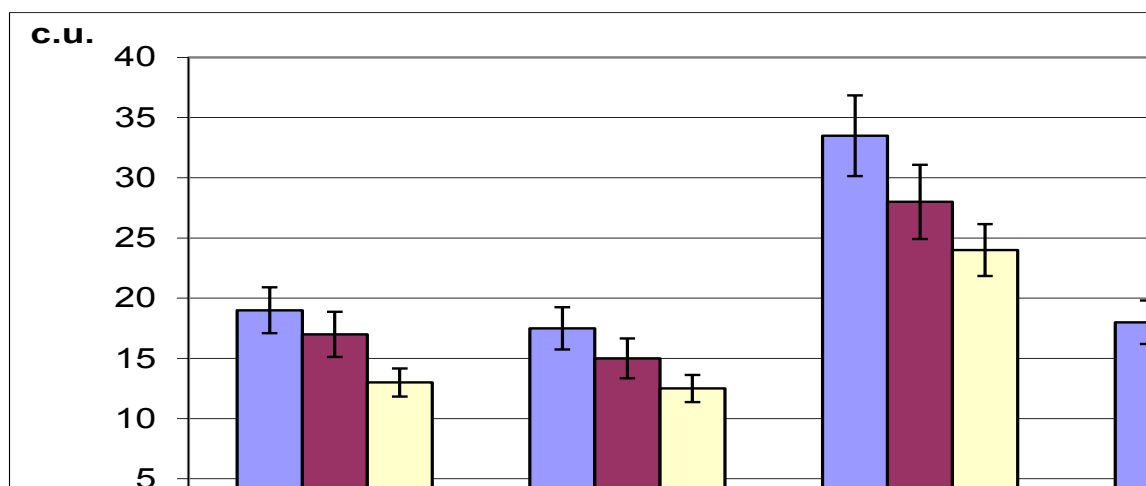


Fig. 2. Test result of "Landolt Rings" accomplished by seamen with the different level of stress resistance (I - high; II - average; III - low) in the period of preparation to the examination

This fact should be taken into account at planning some activities for improving the sustainability to the psychoemotional loading in the conditions of extraordinary situations and organization of medical and psychological rehabilitation in a post-stress period, especially if such dependency takes place also on results of other components of the complex psychophysiological researches (tests of Eyzenck, Lusher, Taylor, "Feeling-Activity-Mood"). Evaluated with individual and personal qualities in their totality create professionally oriented functional system of OIQ. These

markers help us to form the basis of readiness to perform a successful and effective occupational activity, as well as the degree of tolerance for psychoemotional stress.

6. Stress management as a basis for behavior and rational actions under the threat of pirate attacks at sea

The performed complex studies of seamen after returning from trips to areas, potentially dangerous of pirate attacks risk, interviews and psychological training of their families members, as well as the results of modeling psychoemotional stress on full scale simulators has highlighted a number of provisions regarding approaches to medical and psychological rehabilitation of these contingents: 1. In the response to acute stress influences combined changes in the organism, the individual and personal level, which should be considered when planning and implementing rehabilitation program. 2. Since the responses to the dangerous situation depend on the level of stress holding psychotherapeutic interventions should be combined with a training session, providing an increase of individual properties. 3. The observed differences in the qualitative and quantitative markers of response in representatives of different professional groups of cadets, seafarers and their families' members, demanded a differentiated approach to the drafting of rehabilitation programs. This will also take into account differences in performed by seamen occupational tasks.

7. Development of psychophysiological training and rehabilitation system

In view of the research was to propose a set of mental health maintaining and restoring measures, to promote, develop and support a high level of stress, differentially for each group of provisional training and rehabilitants. Ratio of basic elements (lectures, workshops, seminars and training, including auditory training) is shown in Fig. 3. In this context, alternative groups are students and members of the families of seamen who dominate or lectures and workshops, or training.

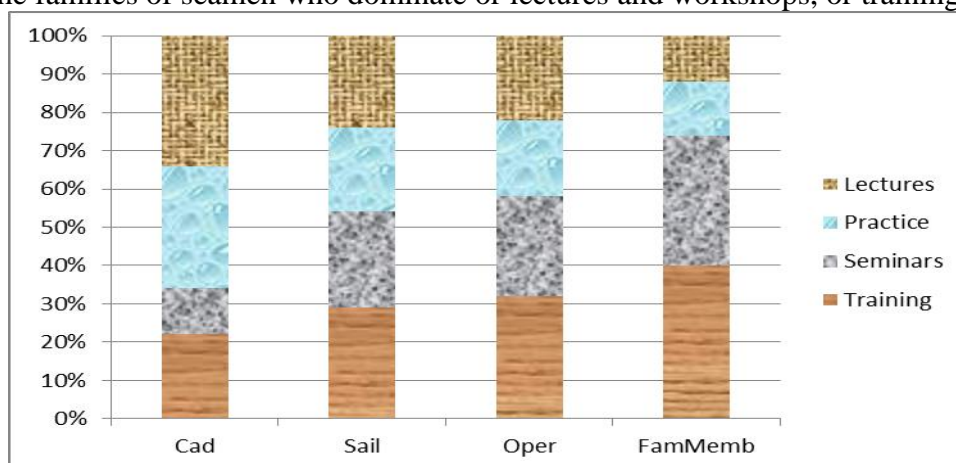


Fig. 3. Structure of the training process of cadets, seamen and their family members

The obtained data formed the basis of criteria proposed indicators (psychophysiological markers) and grading system for ranking the degree of stress on the seafarers, as well as justification provisions developed guidance documents [21-23], intended to increasing stability to stress of cadets during the period of sea practices and of crew members working in areas with high risk of pirate attacks.

CONCLUSIONS

1. In the complication due to the situation on the sea routes associated with the risk of international terrorism and piracy on the high seas significantly increases the importance of seaman's psychophysiological status and the readiness for an adequate response and concerted action in emergencies.
2. Psychophysiological basis while developing overcome psychoemotional stress is a system of individual and personal qualities, which manifests itself as integrally degree of stability to stress and provides an adequate response in terms of danger and reflection pirate attacks.
3. Stress level can be effectively decrease with the help of psychophysiological training, autotraining and other form of psychoemotional status management, as well as preventive and rehabilitative

measures against depression, anxiety, fatigue and other posttraumatic stress disorders. Such methods can be successfully used as a purpose, i.e. before, during and after the emergent situation.

4. As far as the initial stages of distress manifested in working activities, as informative models were used classes of ship operators and marine students on full-scale simulators in the period between voyages. Thus, on the one hand, it was possible to study the effect of "aftereffect" threat of pirate attacks, and on the other, to rank the observed physiological disorders and argue the application of adequate preventive and rehabilitative measures.

5. It was developed and successfully implemented in medical and psychological practice a system of increasing stress resistance in seamen and marine students, combat cumulative fatigue during the trip, and also rehabilitation measures, which are reflected to the made of methodic guidance documents [21-23].

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