The measurement of adhesion forces in the system «cell-cell» by using atomic force microscope

La medición de las fuerzas de adhesión en el sistema «célula-célula» utilizando un microscopio de fuerza atómica.

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Abstract

The last decades in the world are characterized by a steady increase in the number of natural and man-made emergencies. The Republic of Kazakhstan is not an exception to the global patterns of emergency situations. In the period from September 4 to October 6, 2017, a comprehensive study of the state of health of 551 cardiovascular Rescuers in Almaty (Kazakhstan) was carried out according to reports on registered diseases, their outcomes and causes of temporary disability for 2012-2017, and the need for rehabilitation based on a specially designed questionnaire. The study shows the need to develop effective measures for the organization of medical and psychological rehabilitation of cardiovascular Rescuers.

Keywords: natural and man-made emergencies, cardiovascular Rescuers, medical and psychological rehabilitation.

Resumen

Las últimas décadas en el mundo se caracterizan por un aumento constante en el número de emergencias naturales y provocadas por el hombre. La República de Kazajstán no es una excepción a los patrones globales de situaciones de emergencia. En el período comprendido entre el 4 de septiembre y el 6 de octubre de 2017, se llevó a cabo un estudio exhaustivo del estado de salud de 551 rescatistas en Almaty (Kazajstán) de acuerdo con los informes sobre enfermedades registradas, sus resultados y las causas de discapacidad temporal para 2012-2017. y la necesidad de rehabilitación basada en un cuestionario especialmente diseñado. El estudio muestra la necesidad de desarrollar medidas efectivas para la organización de la rehabilitación médica y psicológica de los rescatistas.

Palabras clave: emergencias naturales y provocadas por el hombre, salvadores cardiovasculares, rehabilitación médica y psicológica.

Introduction

The work of a rescuer in dealing with the aftermath of natural and man-made emergencies is one of the most dangerous professions characterized by high traumatism and mortality. On average, 17.7 thousand emergency situations are registered in Kazakhstan annually. Rescue services are the first to respond during emergencies, and the professional duties of cardiovascular Rescuers are related to the performance of physically and psychologically hard work.

The working conditions of cardiovascular Rescuers are characterized by considerable physical exertion, exposure to extreme temperatures, various toxic substances, etc.[1-4]. An analysis of foreign literature shows, that the direct fulfillment of professional duties (for example, extinguishing fires) is associated with a quarter of all accidents, as well as respiratory system diseases and oncological diseases. One-third of those whose professional activities are associated with high risk are observed non-specific abnormalities,

accompanied by a moderate decrease in the functional reserves of the body, state of neuro-psychological stress and, in general, stress adaptation mechanisms[5-7]. A high incidence of depressive state and post-traumatic mental disorders is noted in liquidators of the consequences of the collapse of the New York shopping center[8]. As possible social risks and medico-psychological consequences are most often mentioned: increased frequency and complication of clinical manifestations of post-traumatic stress disorders; an increase in the incidence of chronic alcohol intoxication; drug abuse; the emergence of family conflicts; diseases of a psychogenic nature, obtained during the performance of official duties; the increase in the number of cases of inadequate aggressive reactions and suicidal behavior[9].

Thus, work in conditions of emergency situation leads to pronounced violations, which are manifested, on the one hand, in somatic pathology, and on the other, in the deterioration of psychophysiological indicators and changes in psychological status, which indicates the need for the organization of rehabilitation for cardiovascular Rescuers working in acute and chronic stress conditions.

Methods

To achieve the goal, the following research methods were used:

1. Sociological survey of cardiovascular Rescuers, who took part in the aftermath of emergency situations of natural and man-made nature.
2. Information-analytical analysis of legislative and regulatory documents, reports and current documents, modern scientific-bibliographic sources.
3. Statistical.

The research material was tools of public health policy and regulation, statistical compendiums of the Ministry of Public Health, the Committee for Emergency Situations of the Ministry of Internal Affairs of the Republic of Kazakhstan. To study various aspects of the organization of medical and psychological rehabilitation, we conducted a comprehensive study of the health status of cardiovascular Rescuers of the largest metropolis of Kazakhstan, Almaty, based on data from reports on registered diseases, their outcomes and causes of temporary disability for 2012-2017 and rehabilitation needs based on a specially designed questionnaire.

Results

The criterion for inclusion in the study - mandatory participation in rescue and emergency work in the aftermath of emergencies. The criterion of exclusion - work as a rescuer for less than 1 year. The period of 1 year was regarded by us as sufficient for the formation of disorders due to participation in the aftermath of emergencies.

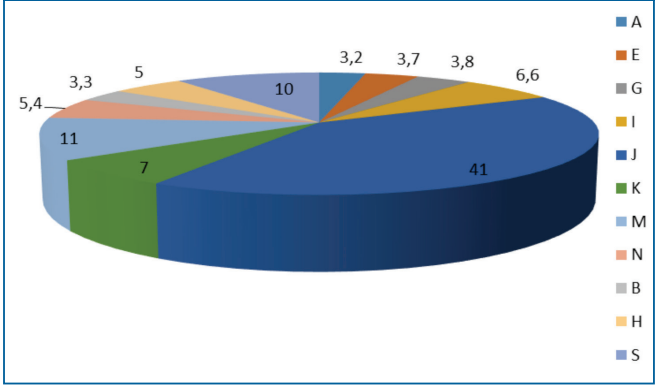
The study involved 551 cardiovascular Rescuers, including firefighters - 271 (49.1%), climbers (mine-rescue worker) -69 (12.5%), divers -37 (6,7%), health workers/psychologists -54 (9,8%), others -120 (21,9%).

Distribution by gender revealed the prevalence of men (87%), which is associated with the specificity of the exposure of female cardiovascular Rescuers to an increased risk of both physical and psychological trauma, which must be taken into account when conducting rescue operations[13].

The age of the examined -19-60 years, the average age - (33.88 + 0.75) years. The work experience as a rescuer is 0-13 years, the average work experience (4.43 + 0.28) years.

In the structure of the general morbidity of cardiovascular Rescuers, the main classes of diseases were ranked as follows: 1st place (41%) - respiratory diseases; 2nd place (11%) - diseases of the musculoskeletal system and connective tissue; 3rd place (10%) - traumas, poisonings and some other consequences of exposure to external causes [Figure 1].

Figure 1 - The structure of the general morbidity of cardiovascular Rescuers.



A -some infectious and parasitic diseases; B -viral infections; E -diseases of the endocrine system; G -diseases of the nervous system; H -diseases of the eye and its adnexa; I – diseases of the circulatory system; J -respiratory diseases; K -diseases of the digestive system; M -diseases of the musculoskeletal system; N -diseases of the genitourinary system; S -traumas, poisoning and some other consequences of exposure to external causes.

The absolute number of primary diseases for the study period - 1703, and labor losses - 41558 days. In the structure of days of labor losses, respiratory diseases occupied the 1st place (36%); 2nd place - traumas, poisonings and some other consequences of external causes (23%); 3rd place - diseases of the musculoskeletal system and connective tissue (10%). Places from the 4th to the 6th took pregnancy, childbirth and the postpartum period, circulatory system diseases and diseases of the digestive system. Their share in the overall morbidity structure ranged from 6 to 4.6%. These 6 classes of diseases gave 86.0% of all days of labor losses.

The most common causes leading to disability were circulatory system diseases - 47.2%; diseases of the musculoskeletal system and connective tissue - 11.1%; tuberculosis, endocrine system diseases and neoplasms - 8.3% each. These 3 classes of diseases accounted for 88.9% of the total number of cases of cardiovascular Rescuers' disability.

In the structure of mortality by disease classes, 50% of cases accounted for the death of cardiovascular Rescuers from traumas; 21.4% for mortality from neoplasms; 20% of cases are deaths from coronary heart disease.

The study of the health status of cardiovascular Rescuers allowed us to establish priority areas for the provision of medical care and rehabilitation:

- primary prevention of diseases of the respiratory system, circulatory system and traumatism prevention;

- comprehensive medical and psychological rehabilitation, aimed at restoring the ability to work and preventing the disability of cardiovascular Rescuers.

Questioning of cardiovascular Rescuers, who participated in emergency response showed, that 85.7% of respondents indicated, that they had to undergo mandatory medical examinations: once a year, 1 hour before the start of the work shift (during the emergency response before and after the work shift), while 6.7% of respondents do not undergo mandatory medical examinations, 7.6% find it difficult to answer (Table 1).

Table 1. Distribution of respondents by answers to the question: "Do mandatory medical examinations conduct to You?" (in absolute numbers and percentages)

Do mandatory medical examinations conduct to You? (1 time per year, 1 hour before the start of the work shift, other)	Absolute numbers	Percentage
Yes	472	85,7
No	37	6,7
Difficult to answer	42	7,6
Total	551	100

The overwhelming majority of respondents 90.4% note health problems, psycho-emotional state after participating in rescue and emergency work, and only 6.5% of respondents answered this question negatively (Table 2).

Table 2. Distribution of respondents by answers to the question: "Did any health problems, psycho-emotional state after participating in rescue and emergency work observe at You?" (in absolute numbers and percentages)

"Did any health problems, psycho-emotional state after participating in rescue and emergency work observe at You?" (in absolute numbers and percentages)	Absolute numbers	Percentage
Yes	498	90,3
No	36	6,5
Difficult to answer	17	3,1
Total	551	100

The majority of surveyed cardiovascular Rescuers 201 (40.3%) report psycho-emotional and psychosomatic diseases after participating in rescue and emergency work, which indicates the leading role of psychological factors in the development of somatic pathology and the possibility of health recovery through influencing the psycho-physiological state of a person (Table 2a).

Table 2a. Distribution of respondents by answers to the question: "If yes, then what kind of health problems were?" (in absolute numbers and percentages)

If yes, then what kind of health problems were?	Absolute numbers	Percentage
Wounds (contusions, traumas, injuries)	114	22,9
Lesions from the effects of chemical, bacteriological, radiation factors	7	1,4
Acute somatic and infectious diseases	75	15,1
Exacerbation of chronic diseases	86	17,3
Psycho-emotional and psychosomatic diseases	201	40,3
Other	15	3
Total	498	100

82.6% of respondents noted, that they needed medical rehabilitation, and only 6.9% noted, that there was no need for rehabilitation (Table 3).

Table 3. Distribution of respondents by answers to the question: "In your opinion, during the work as a rescuer, did You need medical rehabilitation?" (in absolute numbers and percentages)

In your opinion, during the work as a rescuer, did You need medical rehabilitation?	Absolute numbers	Percentage
Yes	456	82,6
No	38	6,9
Difficult to answer	57	10,3
Total	551	100

283 (62.1%) of needy cardiovascular Rescuers received medical rehabilitation, 173 (37.9%) did not receive rehabilitation due to the lack of specialists in rehabilitation in the community; difficulties in obtaining a rehabilitation quota in the framework of the guaranteed volume of free medical care; the lack of a specialized rehabilitation center, as well as the respondent's refusal of rehabilitation and other reasons.

40.4% of respondents needed rehabilitation in conditions of polyclinic, and 28.9% - in the hospital. The need for rehabilitation and sanatorium-and-spa treatment is noted by 15.6% and 15.1%, respectively (Table 4).

Table 4. Distribution of respondents by answers to the question: "What form of rehabilitation did You need?" (in absolute numbers and percentages)

What form of rehabilitation did You need?	Absolute numbers	Percentage
Outpatient care	184	40,4%
Inpatient care	132	28,9%
Rehabilitation treatment	71	15,6%
Spa treatment	69	15,1%
Total	456	82,7

Table 5. Distribution of respondents by answers to the question: "Assess on a scale the quality of the medical rehabilitation You received" (in absolute numbers and percentages)

Assess on a scale the quality of the medical rehabilitation You received	Absolute numbers	Percentage
Very good	97	34,3
Good	81	28,6
Moderately	54	19,1
Bad	7	2,5
Very bad	5	1,8
Difficult to answer	39	13,7
Total	283	100

The number of cardiovascular Rescuers, receiving psychological assistance before / after participating in emergency response is 3 times higher than those, who do not visit a psychologist (Table 6).

Table 6. Distribution of respondents by answers to the question: "Do psychological assistance provide to You before/after participating in emergency response?" (in absolute numbers and percentages)

Do psychological assistance provide to You before/after participating in emergency response?	Absolute numbers	Percentage
Yes	375	68,1
No	127	23
Difficult to answer	49	8,9
Total	551	100

Psychological assistance "very good" helps in the rehabilitation of the psycho-emotional state of 39.8% of respondents; "good" - 23.2% of respondents; "moderately" - 17.3% of respondents, "bad" and "very bad"- 7.2 and 1.3% of respondents, respectively (Table 6a).

Table 6a. Distribution of respondents by answers to the question: "If yes, then how does psychological assistance help in the rehabilitation of Your psycho-emotional state?" (in absolute numbers and percentages)

Table 6. Distribution of respondents by answers to the question: "Do psychological assistance provide to You before/ after participating in emergency response?" (in absolute numbers and percentages)

If yes, then how does psychological assistance help in the rehabilitation of Your psycho-emotional state?	Absolute numbers	Percentage
Very good	149	39,8
Good	87	23,2
Moderately	65	17,3
Bad	27	7,2
Very bad	5	1,3
Difficult to answer	42	11,2
Total	375	100

More than half of respondents (55%) noted the need for psychological rehabilitation, 27.2% of respondents answered negatively, 17.8% of respondents found it difficult to answer this question (Table 7).

Table 7. Distribution of respondents by answers to the question: "In your opinion, during the work as a rescuer, did You need psychological rehabilitation?" (in absolute numbers and percentages)

In your opinion, during your work as a rescuer, did You need psychological rehabilitation?	Absolute numbers	Percentage
Yes	303	55
No	150	27,2
Difficult to answer	98	17,8
Total	551	100

Most respondents 203 (79%) received psychological assistance from in-house psychologists of the emergency services, 9 (3.5%) respondents were provided with inpatient treatment, and 45 (17.5%) indicated other sources (friends, relatives, neighbors, etc.).

Table 8. Distribution of respondents by answers to the question: "If You received psychological rehabilitation, then where?" (in absolute numbers and percentages)

If You received psychological rehabilitation, then where?	Absolute numbers	Percentage
At the place of work by psychologists	203	79
In the clinic by place of residence	-	-
In the hospital	9	
In a rehabilitation center	-	-
Other	45	17,5
Total	257	100

The quality of the received psychological rehabilitation was evaluated by 33.1% and 35.8% of respondents as "very good" and "good", respectively, which indicates a high level of training of psychologists for work in emergency situations (Table 9).

Table 9. Distribution of respondents by answers to the question: "Rate on a scale the quality of the psychological rehabilitation You received" (in absolute numbers and percentages)

Rate on a scale the quality of the psychological rehabilitation You received	Absolute numbers	Percentage
Very good	85	33,1
Good	92	35,8
Moderately	54	21
Bad	2	0,8
Very bad	-	-
Difficult to answer	24	9,3
Total	257	100

Discussion and conclusion

Thus, the study of the health status of cardiovascular Rescuers and the conducted survey indicate the importance of a system of early prevention and rehabilitation of cardiovascular Rescuers. Content-analysis of legal documents, regulating the provision of medical assistance in emergency situations in Kazakhstan, showed, that there are no specialized rehabilitation teams in the country at the emergency medical care stage, as a result of which victims do not have timely access to rehabilitation[14-20]. The rehabilitation of cardiovascular Rescuers is carried out in the Republic of Kazakhstan by state organizations of public health within the guaranteed volume of free medical care[21-23].

A rather high need for rehabilitation requires the creation of a specialized center for the rehabilitation of cardiovascular Rescuers and people, affected in natural and man-made emergencies. Development of the infrastructure of rehabilitation organizations, standardization of services, systemic training of rehabilitation specialists, creation of specialized medical rehabilitation teams to ensure victims' early access to rehabilitation are essential for supporting international disability policy and consistent with the UN Convention on the Rights of Persons with Disabilities, which has been ratified by Kazakhstan in May 2015.

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