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Prenosologic evaluation of status in adult population living in area falled «Proton» launch vehicle

It was evaluated functional status of women and men constantly living in area falled «Proton» launch vehicle. It was identified physiological features with considering living place in township. Studies have shown an accelerated rate of aging in both men and women, as well as differences in the degree of stress of the central heart rate control loop. Taking into account places of residence differences were found between the parameters of PP, PRV, MVB, ADP and IN indices, and in men in ADP, MVB, MBV and AP, indicating that differences are greater in speed and volume characteristics of the system blood circulation, and the most unsatisfactory ratio was registered in men of the Karsakpai settlement. In Karsakpai women, the pulse pressure index (PP) was maximum against the background of low values of minute blood deflection (MBV) with a high value of peripheral vascular resistance (PVR) and low mean dynamic pressure (ADP), which is considered a sign of stagnant phenomena in the vascular bed. Women of Zhezkazgan and men in the village Karsakpai and Satpayev have a fast aging pace and they should pay attention to the lifestyle and if necessary it is recommended to undergo additional examination.

Keywords: adaptation, adult population, aging, cardiovascular system, environmental load, healthy lifestytle, heart rate variability, prenosologic diagnosis, rocket and space activities, prenosologic status.

Introduction

Health condition as ecopathological problem is urgent last decade, whereas there is a tendency to increase and severity of diseases. Assesment of role of adverse effects linked with environment pollution on human body represents the main gap for medical sciences.

The environment is described by the presence of unfavorable anthropogenic factors that can influence on population health and likelihood of developing certain diseases. According to epidemiology of noninfective diseases the highest probability of formation of ecopathology is under the influence of chemical factors [1].

So far, little attention has been paid to the problem of the features of the influence of the environment on the state of health of certain population groups that have different sensitivity to the impact of adverse factors.

At present, changes in the environment have reached a qualitatively new level. The development of industry and transport, the increase in the production and consumption of energy, the intensification and chemicalization of agriculture, everyday life, urbanization and urban growth, the formation of territorial production complexes lead to environmental pollution, which already directly affects the health and morbidity of the population region [2].

In this regard fundamental hygienic research has acquired a new direction. It is definition of quantitative links between changes in the environmental factors and the characteristics of the disruption of population health status at the prepathological and pathological levels of the organism.

The main difficulties in this area are due to the variety of operating factors in environment and the differentiation of their individual influence on the population health: professional activity, living conditions, natural and climatic conditions, heredity.

The methodology for assessment risk of exposure of environmental factors on human health is a new, intensively developed worldwide scientific direction. The principles of this methodology stem from the concept of human hygiene and the environment.

Aim. The goal of this research was to assess population health status in prenosological stage in Zhezkazgan and Satpaev city.

Material and methods

Studies were conducted in 236 adults in Zhezkazgan, Satpaev and Karsakpai settlements in Karaganda region of Republic of Kazakhstan.

Selective method was used to form groups with the distribution of them into age cohorts. The groups included: men and women aged 20 to 60 years who did not have a disability and who were not on dispensary supervision (for the purpose of excluding somatic disability), residing in the territory for more than 10 years.

To assess the cardiovascular system (CVS) blood pressure (BP) was measured. This indicator indirectly reflects the volume of incoming blood to the aorta and therefore it is an important indicator of the functional state of the CVS.

For the subsequent calculations of hemodynamic parameters systolic (SBP) and diastolic (DBP) arterial pressure were recorded taking into account the time of ventricular systole.

Blood pressure measurement was carried out according to the Korotkov method with a Bio-PRESS TM manometer.

Age factor was taken into account in those participants who are over 50 years old. Because elasticity decrease of artery walls, depletion of the capillary system and atherosclerotic processes increase the pressure indices.

We calculated the parameters in terms of physiological parameters of systolic and diastolic pressure (SBP, DBP), heart rate (HR), age (A):

– pulse pressure PP = APS – APD;

– average dynamic pressure ADP = 0.42PP + APD;

– systolic blood volume SBV= 100 + 0,5PP – 0,6APD – 0,6V (A — age of participant);

– minute volume of blood MVB = SBV * HR;

– peripheral resistance of vessels PRV = (SPD * 1333 * 60) / MVB;

– index of circulatory insufficiency ICI = BP_s / HR;

– vegetative index of Kerdo VIK= (1 – APD / HR) * 100 %.

Variational pulsometry was carried by complex «Varikard», «Ramena» (RF, 2005). The measurement was carried out under conditions that corresponded to the requirements described in the guidelines for the study of the autonomic nervous system, as well as the recommendations of the European Association of Cardiology and the North American Association of Electrophysiology and Cardiorhythmology [3].

The electrodes were applied in 1 standard lead. The registration session was accompanied by the measurement of 256 values of 5 minutes RR intervals and calculation of the spectral power density of the cardiointervals.

Biological age (BV) was calculated according to V.P. Voitenko. The analyzed parameters were body weight (MT) in light clothing without shoes, systolic blood pressure (ABP_{sis}), diastolic blood pressure (ABP_{diast}), pulse pressure (AP_p), delayed breathing after deep inspiration (DB_{insp}), delayed breathing after deep exhalation DB_{exhal}), static balancing (SB), vital capacity of lungs (VCL), health self-assessment index (HSA).

Results and discussion

The ratio of the activity of peripheral hemodynamic parameters in women taking into account the places of residence is presented in Table 1.

Table 1

The ratio of the activity of peripheral hemodynamic parameters in women

Physiological indices	Valid N	Mean	Confidence –95.000 %	Confidence +95.000 %	Std. Dev.	Standard Error
1	2	3	4	5	6	7
Zhezkazgan						
Age	75	45.42667	42.43392	48.41941	13.00745	1.501971
SBP	75	125.8667	120.5162	131.2171	23.25495	2.685251
DBP	75	79	75.97402	82.02598	13.15192	1.518653
PULSE	75	82.04	78.03907	86.04093	17.38937	2.007952
PP	75	43.13333	40.43361	45.83306	11.73391	1.354915
ADP	75	141.8493	135.2804	148.4183	28.55081	3.296763
SBV	75	45.95067	43.33644	48.56489	11.36228	1.312003
MVD	75	3805.32	3490.313	4120.327	1369.126	158.093
PRV	75	3505.724	3061.506	3949.943	1930.721	222.9405
VIK	75	0.02169	–0.08308	0.039701	0.266828	0.030811

Continuation of Table 1

1	2	3	4	5	6	7
Q	75	3.513088	3.30775	3.718427	0.892471	0.103054
II	75	126.3035	119.4912	133.1157	29.60835	3.418877
ICI	75	1.565436	1.468947	1.661926	0.419375	0.048425
AP	75	2.83836	2.691726	2.984994	0.63732	0.073591
Satpaev						
Age	126	45.60317	43.112	48.09435	14.12916	1.258726
SBP	126	129.1667	124.9857	133.3476	23.71287	2.11251
DBP	126	82.7381	80.61468	84.86152	12.04337	1.072909
PULSE	126	41.54762	38.9266	44.16864	14.86559	1.324332
PP	126	143.2833	137.8779	148.6887	30.65782	2.731216
ADP	126	42.84048	40.85807	44.82288	11.24357	1.001657
SBV	126	3515.293	3300.371	3730.215	1218.972	108.5947
MVD	126	3765.448	3443.872	4087.024	1823.881	162.4842
PRV	126	–0.07355	–0.12351	–0.02359	0.283349	0.025243
VIK	126	3.467133	3.316927	3.61734	0.851925	0.075895
Q	126	121.2985	116.95	125.6471	24.66348	2.197197
II	126	1.606136	1.519952	1.692321	0.488812	0.043547
ICI	126	2.866222	2.751864	2.98058	0.648603	0.057782
Karsakpai						
Age	5	45.8	26.33714	65.26286	15.67482	7.009993
SBP	5	138	127.6115	148.3885	8.3666	3.741657
DBP	5	82	65.81068	98.18932	13.0384	5.830952
PULSE	5	46	39.19913	52.80087	5.477226	2.44949
PP	5	151.32	125.0773	177.5627	21.13509	9.451899
ADP	5	43.92	27.42259	60.41741	13.28653	5.941919
SBV	5	3311.4	2417.5	4205.3	719.9214	321.9586
MVD	5	3889.806	2188.305	5591.308	1370.34	612.8347
PRV	5	–0.11523	–0.30583	0.07536	0.153498	0.068647
VIK	5	3.208333	2.744149	3.672518	0.373841	0.167187
Q	5	118.7	102.2638	135.1362	13.23725	5.919877
II	5	1.71416	1.501789	1.926531	0.171037	0.07649
ICI	5	2.9892	2.141276	3.837124	0.682893	0.305399

Differences were revealed between residences in different places in PP, SBV, PRV, MVB, ADP and IN indices. These indicators more characterize the velocity and volume characteristics of blood in peripheral vessels.

Related to blood pressure parameters to the values of the age norm (mean sample age is 45 years) it was revealed that indices were slightly higher and large range of differences was recorded mainly on the parameters of diastolic pressure.

The data indicate that in Karsakpai women, the pulse pressure index (PP) was maximum against the background of low values of minute blood deflection (MVD) with a high value of peripheral vascular resistance (PRV) and low mean of dynamic pressure (ADP), which is considered a sign of stagnation in vascular canal.

Biological age (BA) is an integrated expression of age pathology hidden or manifested in the form of not diagnosed diseases. Passport age (PA) although is a convenient measure which assesses the probability of functional capacity reducing in person and worsening his health state, however it is not an ideal measure due to the significant individual variability of aging of the organism.

Available data indicate that there are certain statistical relationships between rate of aging and a numerous social-hygienic factors that can be determined applying to a specific situation of human life.

Depending on the used methods to determine BA may reflect a decrease functional capacity of the body and its performance (functional age) or a decrease body's viability (gerontological age) [4, 5]. The available data in the literature indicate that biological age is an adequate indicator of a person's functional state. Today problem of assessing BA is closely related to the concept of physiological (normal) and pathological (premature) aging. This determines its importance during the solving a number of problems related topreventive ones, if take into account that the living conditions of a person can exert significant influence on BA.

The mean values of PA and BA were coincided only in women from Zhezkazgan, in women from Satpayev this difference was 1 year, and 4 years in women from Karsakpay.

Statistics on the rate of aging indicate that the degree of aging in Satpayev's women is consistent with statistical standards, for women in Zhezkazgan the degree of aging for 1 year is accelerated and they should pay attention to the lifestyle and, if necessary it is recommended to undergo a clinical and laboratory test, in women from Karsakpai the degree of aging was small.

In the SR index, it was revealed that according to the activity of regulatory systems, the women of the Karsakpay settlement (RSAI = 5) were more profitable in functional activity, although they were in the range of «sharply expressed functional tension».

This position is more favorable in relation to the others, because testifies to the active mobilization of protective mechanisms, including an increase an activity of sympatho-adrenal system and the pituitary-adrenal system [6, 7].

The most unsatisfactory position in the levels of functional tension was in women from Zhezkazgan, in whom the degree of centralization in the regulation of the structure of the SR contributed to a decrease in the activity of the autonomous circuit (in the form of a decrease in the spectrum of high-frequency waves (HF%) against the background of high values of the SDR index (624.9 ms. with a normal range of 40–80 ms).

Statistical indicators of the physiological status in men linked with places of residence are presented in Table 2.

Table 2

Indicators of physiological status in men taking linked with places of residence

Physiological indices	Valid N	Mean	Confidence –95.000 %	Confidence +95.000 %	Std. Dev.	Standard Error
1	2	3	4	5	6	7
Zhezkazgan						
Age	10	50.6	40.52726	60.67274	14.08072	4.452715
Height	10	167.9	164.2144	171.5856	5.15213	1.629247
Weight	10	73.4	65.03579	81.76421	11.69235	3.697447
SBP	10	123	111.7902	134.2098	15.67021	4.955356
DBP	10	78	71.42632	84.57368	9.189366	2.905933
pulse	10	71.2	68.38263	74.01737	3.938415	1.245436
Din.dex	10	47.8	42.22001	53.37999	7.800285	2.466667
Din.sin	10	40.6	36.1237	45.0763	6.25744	1.978776
SAH	10	14.3	9.638883	18.96112	6.515793	2.060475
FBA	10	57.6944	51.82089	63.56791	8.2106	2.59642
DBA	10	50.3874	44.05165	56.72315	8.856773	2.800757
FBA-DBA	10	7.307	2.28134	12.33266	7.025389	2.221623
FBA-PA	10	7.0944	–0.48508	14.67388	10.59538	3.350553
PP	10	45	38.04798	51.95202	9.718253	3.073181
ADP	10	96.9	88.77182	105.0282	11.36241	3.593111
SBV	10	45.34	37.62385	53.05615	10.78643	3.410969
MBV	10	3215.14	2697.241	3733.039	723.9728	228.9403
PRV	10	2533.62	2054.745	3012.494	669.4208	211.6894
VIK	10	–0.09971	–0.20917	0.009757	0.153021	0.048389
Q	10	3.008212	2.866447	3.149978	0.198174	0.062668
II	10	112.2744	106.7152	117.8336	7.771227	2.457478
ICI	10	1.737481	1.533586	1.941375	0.285025	0.090133
AP	10	2.7171	2.402338	3.031862	0.440007	0.139143
Satpaev						
Age	24	46.5	38.51915	54.48085	18.9002	3.857986
Height	24	168.375	165.6933	171.0567	6.35071	1.296333
Weight	24	75.625	69.73064	81.51936	13.95898	2.849366
SBP	24	127.9167	121.0989	134.7345	16.14585	3.295757
DBP	24	87.29167	83.02433	91.559	10.10587	2.062852
Pulse	24	84.08333	77.386	90.78067	15.86058	3.237527
Din.dex	24	43.95833	39.59755	48.31911	10.32717	2.108024

Continuation of Table 2

1	2	3	4	5	6	7
Din.sin	24	41.875	37.33679	46.41321	10.74735	2.193793
SAH	24	16.25	13.65819	18.84181	6.137908	1.252895
FBA	24	60.90088	57.76916	64.03259	7.416498	1.513886
DBA	24	47.8085	42.78854	52.82846	11.88822	2.426673
FBA-DBA	24	13.09238	9.308088	16.87666	8.961921	1.829344
FBA-PA	24	14.40088	8.028018	20.77373	15.09215	3.080673
PP	24	40.625	36.29753	44.95247	10.24828	2.091921
ADP	24	104.3542	99.30218	109.4062	11.96408	2.442157
SBV	24	40.0375	34.83565	45.23935	12.31898	2.514601
MBV	24	3370.929	2837.439	3904.42	1263.409	257.8922
PRV	24	2902.762	2302.16	3503.364	1422.342	290.3343
VIK	24	–0.07138	–0.16736	0.024595	0.227292	0.046396
Q	24	3.430651	3.187913	3.673388	0.574849	0.117341
II	24	123.4495	113.0495	133.8495	24.62917	5.027407
ICI	24	1.569104	1.423765	1.714442	0.344189	0.070257
AP	24	2.960333	2.707291	3.213376	0.599253	0.122322
Karsakpai						
Age	5	36.4	21.77153	51.02847	11.78134	5.268776
Height	5	166.4	160.2166	172.5834	4.97996	2.227106
Weight	5	62.6	46.78157	78.41843	12.7397	5.697368
SBP	5	128	122.4471	133.5529	4.472136	2
DBP	5	82	76.44711	87.55289	4.472136	2
pulse	5	93.8	66.84702	120.753	21.70714	9.707729
Din.dex	5	48	36.89422	59.10578	8.944272	4
Din.sin	5	43.2	30.95843	55.44157	9.859006	4.409082
SAH	5	12.8	7.430611	18.16939	4.32435	1.933908
FBA	5	58.5602	54.78877	62.33163	3.037396	1.358365
DBA	5	41.4556	32.25429	50.65691	7.410464	3.31406
FBA-DBA	5	17.1046	10.91637	23.29283	4.983817	2.228831
FBA-PA	5	22.1602	10.67619	33.64421	9.24889	4.13623
PP	5	46	39.19913	52.80087	5.477226	2.44949
ADP	5	101.32	96.89647	105.7435	3.562583	1.593236
SBV	5	51.96	40.47558	63.44442	9.249216	4.136375
MBV	5	4928.76	2777.579	7079.941	1732.498	774.7968
PRV	5	1800.172	1099.47	2500.874	564.325	252.3738
VIK	5	0.081587	–0.21995	0.383121	0.242847	0.108604
Q	5	3.871	2.792647	4.949353	0.868474	0.388393
II	5	147.5528	99.09412	196.0114	39.02719	17.45349
ICI	5	1.424837	1.018685	1.830988	0.327103	0.146285
AP	5	2.7852	2.300194	3.270206	0.390609	0.174686

Rapid rate of aging was found in men in Karsakpai and Satpaev settlements (Fig. 1).

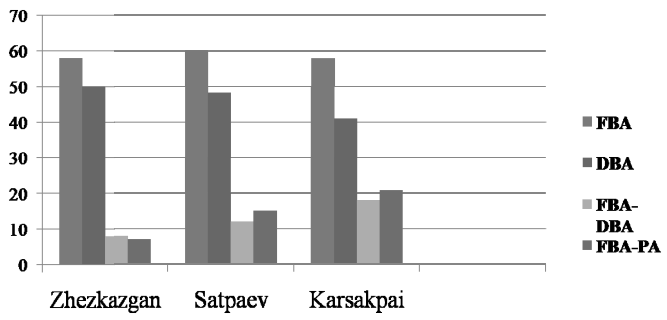

Figure 1. Ratio of BA in men according to place of residence

There were differences in the settlements among the indicators of ADP, PRV, MBV, AP. Like women these indicators differed in volume and velocity characteristics and in the men of the Karsakpai settlement were the most unsatisfactory results (Fig. 2).

Calculation of the AP index showed that the men from Satpaev and Karsakpai settlement had satisfactory functional capacities of the circulatory system with moderate tension of the regulation mechanisms, and in the men from Zhezkazgan the functional capacities of the circulatory system were good.

In terms of cardiac rhythm, partly in quantitative characteristics of normal cardiac intervals RR, which we estimated by the RMSSD index, it was revealed that this was from the sample of the man from Zhezkazgan.

By frequency characteristics, it was revealed that low frequency waves (VLF%) dominated in the spectrum in all settlements, and the differences were in the ratios of high-frequency (HF%) and vasomotor (LF%) waves (Fig. 2).

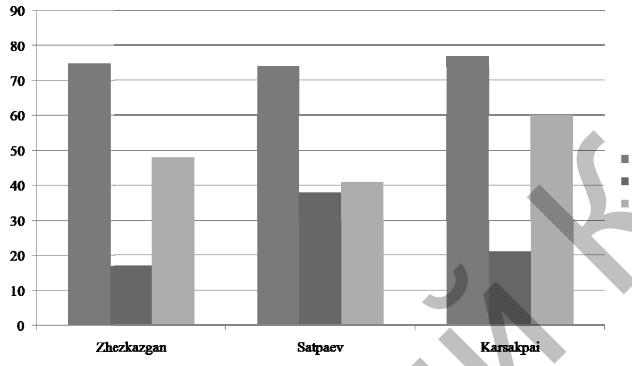

Figure 2. Ratio of spectral characteristics

It was revealed that men from Karsakpai settlement are in a more unsatisfactory state, especially they entered the range of «pronounced tension of regulatory systems», which is typical for the states of active mobilization of protective mechanisms.

Conclusions

1. Taking into account places of residence differences were found between the parameters of PP, PRV, MVB, ADP and IN indices, and in men in ADP, MVB, MBV and AP, indicating that differences are greater in speed and volume characteristics of the system blood circulation, and the most unsatisfactory ratio was registered in men of the Karsakpai settlement. In Karsakpai women, the pulse pressure index (PP) was maximum against the background of low values of minute blood deflection (MBV) with a high value of peripheral vascular resistance (PVR) and low mean dynamic pressure (ADP), which is considered a sign of stagnant phenomena in the vascular bed.

2. Women of Zhezkazgan and men in the village Karsakpai and Satpayev have a fast aging pace and they should pay attention to the lifestyle and if necessary it is recommended to undergo additional examination.

3. In terms of SR in women it was revealed that the activity of regulatory systems in the more profitable functional activity was women of the Karsakpai settlement (RSAI = 5), although they were in the range of «sharply expressed functional tension», and the men of Karsakpai were in more unsatisfactory state and entered the range of «pronounced regulatory system voltage» which is characteristic of states of active mobilization of protective mechanisms. It was revealed that low frequency waves (VLF%) dominated in the spectrum in all settlements, and the differences were in the ratios of high-frequency (HF%) and vasomotor (LF%) waves.

4. The most unsatisfactory position was in levels of functional tension in women from Zhezkazgan, in whom the degree of centralization in the regulation of the structure of the SR contributed to a decrease in the activity of the autonomous circuit (in the form of a decrease in the spectrum of high-frequency waves (HF%) against the background of high values of the SDR (624.9 ms with a normal range of 40–80 ms).

5. Calculation of the AP index showed that in men from Satpaev and Karsakpai the functional capacities of the circulatory system function with moderate voltage of the regulatory mechanisms.

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«Протон» зымыран тасымалдағышы құлаған аймақта өмір сүретін ересек контингенттің нозологияға дейінгі мәртебесін бағалау

Мақалада «Протон» зымыран тасымалдағышы құлаған аймақта тұрақты өмір сүретін ерлер мен әйелдердің функционалдық жағдайына баға берілген. Тұрғылықты жерлеріне байланысты физиологиялық ерекшеліктері анықталды. Зерттеулер ерлерде де, әйелдерде де қартаю қарқынын жылдамдауын және жүрек ритмін бақылаудың орталық контурының кернелу деңгейінің айырмашылықтарын анықтады. Тұрғылықты жеріне байланысты әйелдер арасында гемодинамиканың ПҚ, ҚСК, ТПК, ҚМК, ОДҚ, ҚЖИ көрсеткіштерінде, ал ерлер арасында ПҚ, ҚСК, ТПК, ҚМК көрсеткіштерінде айырмашылықтар байқалды. Олар көбіне қан айналым жүйесінің жылдамдық және көлемдік сипаттамаларын қамтиды және Қарсақпай ауылының ер тұрғындары арасындағы нәтиже қолайсыз мәнге ие болды. Қарсақпай ауылының әйел тұрғындары арасында үлкен қан қысым және қанның минуттық көлемінің төмен нәтижелері тамырлардың жоғары перифериялық кедергісі аясында анықталды. Бұл тамыр арнасындағы іркілістік құбылыстардың бар екендігін көрсетеді. Қартаю бойынша статистикалық нәтижелер Жезқазған қаласының әйелдері мен Қарсақпай және Сатпаев қаласының ерлерінде қартаю үрдісі жылдам жүретінін көрсетті. Аталған контингентке өмір салтына мән беруге және қосымша тексеруден өтуге кеңес берілді.

Кілт сөздер: бейімделу, ересек халық, қартаю, жүрек-қантамыр жүйесі, экологиялық жүктеме, жүрек ритмінің вариабелділігі, нозологияға дейінгі диагностика, зымыран-ғарыштық жұмыс, нозологияға дейінгі мәртебе, салауатты өмір салты.

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Донозологическая оценка статуса взрослого контингента, проживающего на территории падения ракетоносителя «Протон»

В статье дана донозологическая оценка функционального состояния мужчин и женщин, постоянно проживающих на территории районов падения РН «Протон». Выявлены физиологические особенности с учетом мест проживания в поселках. Исследования показали ускоренный темп старения как у мужчин, так и у женщин, а также различия в степени напряжения центрального контура управления сердечным ритмом. В гемодинамике у женщин, с учетом мест проживания, были выявлены отличия между показателями ПД, СОК, ПСС, МОК, СДД, ИН, а у мужчин — в СДД, ПСС, МОК и АП, свидетельствующие, что различия наблюдаются больше в скоростных и объемных характеристиках системы кровообращения. Наиболее неудовлетворительные соотношения были зарегистрированы у мужчин п. Карсакпай. У женщин п. Карсакпай показатель пульсового давления (ПД) был максимальным на фоне низких значений минутного отклонения крови (МОК) при высоком значении периферического сопротивления сосудов (ПСС) и низком среднединамическом давлении (СДД), что считается признаком застойных явлений в сосудистом русле. Статистические данные по темпу старения свидетель-

ствуют о быстром темпе старения у женщин г. Жезказгана и у мужчин п. Карсакпай и г. Сатпаев. Им следует обратить внимание на образ жизни и при необходимости рекомендуется прохождение дополнительного обследования.

Ключевые слова: адаптация, взрослое население, старение, сердечно-сосудистая система, экологическая нагрузка, здоровый образ жизни, вариабельность сердечного ритма, донозологическая диагностика, ракетно-космическая деятельность, донозологический статус.

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