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New Program for Estimation of Degree of the Patient's severity

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Abstract

Based on parameters of the previously developed by the author universal analytical system of physiological condition of the body (PHUAS) a new algorithm for assessing of the patient's severity was proposed. Algorithm of computer program allows identify risk groups among patients in severity general condition automatically quickly and objectively. Also, it permits to determine optimal and efficient options of prevention and treatment, avoid in-depth examinations that can save both time and money. The data that were obtained could be used for the subsequent correlation with various factors that influencedon organism. These factors were such as ecology, nutrition, medications, vaccine, methods of intensive therapy, pharmacotherapy, etc. In general, the proposed algorithm allows estimating the severity of the patient's health, improving welfare of the population in terms of underfunding by means objective and rapid examination of a large number of people.

Keywords: Algorithms; Program of PHUAS; Assess; Physiological condition; Severity; Prevention; Efficiency of treatment; Correlation

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Introduction

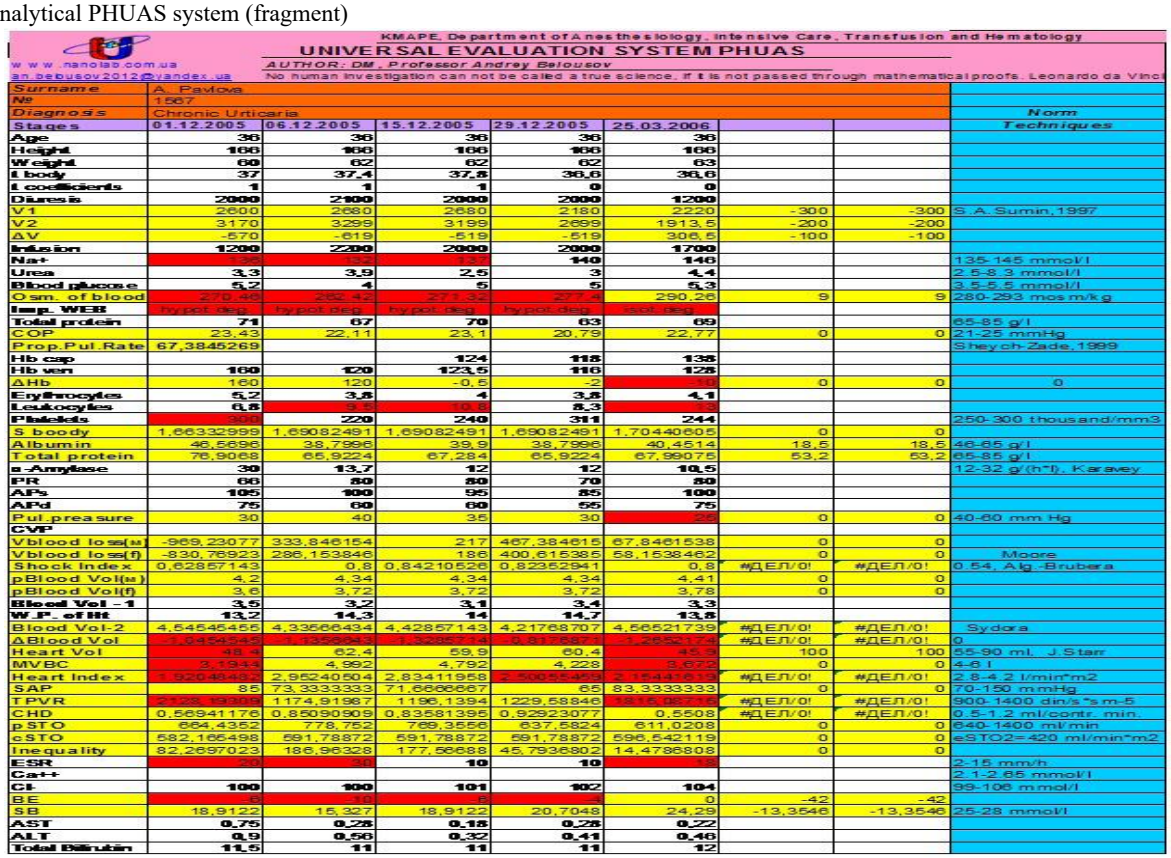
At present, the doctor's arsenal has few tens of rating scales, most of which have been used in the practice of intensive care units. Some of them have received global popularity and have been used in virtually all countries of the world (such as APACHE, SAPS, TISS), others (MPM, TOSS) have been applied more rarely[1,2]. Objective assessment of the severity of the patient's condition is a necessary tool for decision-making on management of patients, solving the problems of transporting them and the optimum placement of patient care (emergency department, specialized department, ICU, etc.), comparison the outcomes of patients depending on the therapies and quality of care. The latest versions of rating scales (APACHE III, SAPS II) were build on new principles of construction - selection and weighting of variables, which based on statistical modeling techniques and the risk of death was estimated by means multiple logistic regression model[3].

Today most of hospitals district and city centers have the significant deficiency of technical equipment, so using of theseevaluation systems are objectively impossible. Many scoring systems are very time-consuming and cumbersomethemselves, and, therefore, they need to be updated and improvedconstantly.Besides, each of these systems scoring has its own specific variables for assessing of the severity of the disease. It determines not only their specifics butsubjective approach in assessment of the parameters.

Therefore, every physician who has used a particular evaluation system in practiceoften finds out inconsistency between of clinical severity of patient and result of assessment. Due this fact, the forecast of mortality is not always veridical.Another important disadvantage of the above evaluation systems is the inability to conduct a complex analysis of clinical and laboratory data. In 1990, in Leningrad, on the basis of LMT the software-Research Module for analysis of clinical and laboratory data (GEMA) was first developed. The first version of intellectual medical system was created on this basis in 1993. This software package was namedOMIS[4].

However, intelligent computer OMISsystem couldn'tbe objective in general cases. The computer system wasn'table to take into account all nuances of individual clinical and laboratory data. New universal analytical evaluative system of the physiological state of the organism (PHUAS) that was created by the author was an attempt of combining the positive aspects of the above evaluative systems[5] (Figure 1).

Figure 1: Analytical PHUAS system (fragment)



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UNIVERSAL EVALUATION SYSTEM PHUAS

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No human investigation can not be called a true science, if it is not passed through mathematical proofs. Leonardo da Vinci

Surname	A. Pavlova							
№	1567							
Diagnosis	Chronic Urticaria							Norm
Stages	01.12.2005	06.12.2005	15.12.2005	29.12.2005	25.03.2006			Techniques
Age	38	38	38	38	38			
Height	166	166	166	166	166			
Weight	60	62	62	62	63			
t body	37	37,4	37,8	36,6	36,6			
t coefficients	1	1	1	0	0			
Duresis	2000	2100	2000	2000	1200			
V1	2600	2680	2680	2180	2220	-300	-300	S.A.Sumin,1997
V2	3170	3299	3199	2699	1913,5	-200	-200	
ΔV	-570	-619	-519	-519	306,5	-100	-100	
Infusion	1200	2200	2000	2000	1700			
Na+	135	135	135	140	140			135-145 mmol/l
Urea	3,3	3,9	2,5	3	4,4			2.5-8.3 mmol/l
Blood glucose	5,2	4	5	5	5,3			3.5-5.5 mmol/l
Osm. of blood	270,45	282,4	271,25	277,8	290,25	9	9	280-293 mosm/kg
Imp. WBE	hypot.deg.	hypot.deg.	hypot.deg.	hypot.deg.	isot.deg.			
Total protein	71	67	70	63	69			65-85 g/l
COP	23,43	22,11	23,1	20,79	22,77	0	0	21-25 mmHg
Prop.Pul.Rate	67,3845269							Sheych-Zade,1999
Hb cap			124	118	138			
Hb wen	160	120	123,5	116	128			
ΔHb	160	120	-0,5	-2	12	0	0	0
Erythrocytes	5,2	3,8	4	3,8	4,1			
Leukocytes	6,8	9,6	10,8	8,3	13			
Platelets	300	220	240	311	244			250-300 thousand/mm3
S boody	1,66332999	1,69082491	1,69082491	1,69082491	1,70440605	0	0	
Albumin	46,5696	38,7996	39,9	38,7996	40,4514	18,5	18,5	46-65 g/l
Total protein	76,9068	65,9224	67,284	65,9224	67,99075	53,2	53,2	65-85 g/l
α-Amylase	39	13,7	12	12	10,5			12-32 g/(h*l), Karavey
PR	95	80	80	70	80			
APs	105	100	95	85	100			
APd	75	60	60	55	75			
Pul.preasure	30	40	35	30	25	0	0	40-60 mm Hg
CVP								
Vblood loss(m)	-969,23077	333,846154	217	467,384615	67,8461538	0	0	
Vblood loss(f)	-830,76923	286,153846	186	400,615385	58,1538462	0	0	Moore
Shock Index	0,62857143	0,8	0,84210526	0,82352941	0,8	#ДЕЛ/0!	#ДЕЛ/0!	0.54, Alg.-Brubera
pBlood Vol(m)	4,2	4,34	4,34	4,34	4,41	0	0	
pBlood Vol(f)	3,6	3,72	3,72	3,72	3,78	0	0	
Blood Vol - 1	3,5	3,2	3,1	3,4	3,3			
W.F. of Ht	13,2	14,3	14	14,7	13,8			
Blood Vol-2	4,54545455	4,33566434	4,42857143	4,21768707	4,56521739	#ДЕЛ/0!	#ДЕЛ/0!	Sydora
ΔBlood Vol	-1,0454545	-1,1356643	-1,3285714	-0,817687	-1,2652174	#ДЕЛ/0!	#ДЕЛ/0!	0
Heart Vol	48,4	62,4	59,9	60,4	45,9	100	100	55-90 ml, J.Starr
MVBC	2,1944	4,992	4,792	4,228	3,672	0	0	4-8 l
Heart Index	1,92648403	2,95240504	2,83411958	2,50035461	2,1544513	#ДЕЛ/0!	#ДЕЛ/0!	2.8-4.2 l/min*m2
SAP	85	73,3333333	71,6666667	65	83,3333333	0	0	70-150 mmHg
TPVR	2328,19008	1174,91967	1196,1394	1229,58846	1815,06215	#ДЕЛ/0!	#ДЕЛ/0!	900-1400 din/s*s m-5
CHD	0,56941176	0,85090909	0,83581395	0,92923077	0,5508	#ДЕЛ/0!	#ДЕЛ/0!	0.5-1.2 ml/contr. min.
pSTO	664,4352	778,752	769,3556	637,5824	611,0208	0	0	640-1400 ml/min
cSTO	582,165498	691,78872	691,78872	691,78872	596,542119	0	0	eSTO2=420 ml/min*m2
Inequality	82,2697023	186,96328	177,56688	45,7936802	14,4786808	0	0	
ESR	20	30	10	10	15			2-15 mm/h
Ca++								2.1-2.65 mmol/l
Cl	100	100	101	102	104			99-106 mmol/l
BE	-5	-10	-5	-3	0	-42	-42	
SB	18,9122	15,327	18,9122	20,7048	24,29	-13,3546	-13,3546	25-28 mmol/l
AST	0,75	0,28	0,18	0,28	0,22			
ALT	0,9	0,56	0,32	0,41	0,46			
Total Bilirubin	11,5	11	11	11	12			

Analytical PHUAS systemcontains different formulas that are used in medicine (for example,Astrup, Starr, De-Rittis, Algover-Bruber, Sydore, Sheych-Zade, Moore, Sumin and others). The PHUAS system allows to receive 74 integral parameters from 54 obtained analytical parameters by using of software Excel. The data obtained from 128 indicators allow the practitioner to assess objectively the overall picture of the reaction of compensatory mechanisms of physiological and pathophysiological processesand also reliably identify the basic syndrome disease, observe of the pathological process and effectiveness of the therapy.The data of evaluative system that have been obtainedin dynamics after four measurements transfer automatically to the table for calculating of the coefficient ofcorrelation, with reliability $p < 0.05$. It allows to reveal the basic pathogenic links of the disease, key clinical and biochemical parameters (Figure 2).

Figure 2: Calculation of the coefficient of correlation by using PHUAS (fragment)

Creatinine	Amylase	BV	BR	MVB	MVL	CaO2	PaO2	Cons. O2	PaO2/FiO2	Ca-v
-0,774597	-0,2404	0,258199	#ДЕЛ/0!	0,258199	0,258199	-0,111206	-0,111206	0,914015	-0,111206	-0,111206
-0,333333	-0,245818	0,333333	#ДЕЛ/0!	0,333333	0,333333	-0,324051	-0,324051	0,613293	-0,324051	-0,324051
0,524733	-0,273889	0,184178	#ДЕЛ/0!	0,184178	0,184178	-0,187773	-0,187773	-0,40254	-0,187773	-0,187773
-0,387928	0,982943	-0,393651	#ДЕЛ/0!	-0,382051	-0,993251	0,994739	0,994739	-0,393675	0,994739	0,994739
0,225494	-0,953573	0,97714	#ДЕЛ/0!	0,97714	0,97714	-0,964728	-0,964728	0,540069	-0,964728	-0,964728
0,75665	-0,135135	0,050443	#ДЕЛ/0!	0,050443	0,050443	-0,111113	-0,111113	-0,71773	-0,111113	-0,111113
-0,19935	0,220001	-0,142393	#ДЕЛ/0!	-0,142393	-0,142393	0,09357	0,09357	0,132596	0,09357	0,09357
0,246183	0,410313	-0,492366	#ДЕЛ/0!	-0,492366	-0,492366	0,481684	0,481684	-0,648432	0,481684	0,481684
0,758597	-0,077291	-0,006502	#ДЕЛ/0!	-0,006502	-0,006502	-0,059691	-0,059691	-0,75553	-0,059691	-0,059691
-0,39553	0,979311	-0,990323	#ДЕЛ/0!	-0,990323	-0,990323	0,996706	0,996706	-0,385516	0,996705	0,996706
-0,881104	0,000333	-0,002891	#ДЕЛ/0!	-0,002891	-0,002891	0,716194	0,716194	-0,358044	0,716194	0,716194
-0,455312	0,98494	-0,98856	#ДЕЛ/0!	-0,98856	-0,98856	1	1	-0,324847	1	1
-0,396059	0,979579	-0,990148	#ДЕЛ/0!	-0,990148	-0,990148	0,996691	0,996691	-0,384939	0,996691	0,996691
-0,214944	-0,799055	0,801154	#ДЕЛ/0!	0,801154	0,801154	-0,701898	-0,701898	0,797187	-0,701898	-0,701898
-0,374634	-0,715806	0,749269	#ДЕЛ/0!	0,749269	0,749269	-0,652336	-0,652336	0,925637	-0,652336	-0,652336
-0,522233	-0,452425	0,522233	#ДЕЛ/0!	0,522233	0,522233	-0,44771	-0,44771	0,915406	-0,44771	-0,44771
0,339373	-0,994773	0,984481	#ДЕЛ/0!	0,984481	0,984481	-0,962492	-0,962492	0,418506	-0,962492	-0,962492
0,830554	0,101206	-0,114415	#ДЕЛ/0!	-0,114415	-0,114415	-0,03595	-0,03595	-0,854838	-0,03595	-0,03595
0,27591	-0,965945	0,985393	#ДЕЛ/0!	0,985393	0,985393	-0,978001	1	0,497325	-0,978001	-0,978001
-0,000884	-0,886247	0,915905	#ДЕЛ/0!	0,915905	0,915905	-0,860732	-0,860732	0,7605	-0,860732	-0,860732
-0,074018	-0,879949	0,91038	#ДЕЛ/0!	0,91038	0,91038	-0,853892	-0,853892	0,76891	-0,853892	-0,853892
-0,70117	0,923656	-0,901504	#ДЕЛ/0!	-0,901504	-0,901504	0,94214	0,94214	-0,017396	0,94214	0,94214
-0,290789	0,991106	-0,998826	#ДЕЛ/0!	-0,998826	-0,998826	0,982746	0,982746	-0,485808	0,982746	0,982746
0,58526	-0,969923	0,965271	#ДЕЛ/0!	0,965271	0,965271	-0,991454	-0,991454	0,201238	-0,991454	-0,991454
-0,694133	-0,338431	0,445438	#ДЕЛ/0!	0,445438	0,445438	-0,324847	-0,324847	1	-0,324847	-0,324847
0,522233	0,2035	-0,174078	#ДЕЛ/0!	-0,174078	-0,174078	0,177799	0,177799	-0,407946	0,177799	0,177799
#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!
0,870388	-0,587655	0,522233	#ДЕЛ/0!	0,522233	0,522233	-0,584808	-0,584808	-0,450161	-0,584808	-0,584808
0,662286	0,046151	-0,132453	#ДЕЛ/0!	-0,132453	-0,132453	0,076807	0,076807	-0,76322	0,076807	0,076807
0,173528	0,816461	-0,856108	#ДЕЛ/0!	-0,856108	-0,856108	0,79359	0,79359	-0,825606	0,79359	0,79359
#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!
0,798447	-0,850923	0,832424	#ДЕЛ/0!	0,832424	0,832424	-0,899554	-0,899554	-0,120839	-0,899554	-0,899554
-0,455312	0,98494	-0,98856	#ДЕЛ/0!	-0,98856	-0,98856	1	1	-0,324847	1	1
-0,320726	0,983351	-0,928941	#ДЕЛ/0!	-0,928941	-0,928941	0,891624	0,891624	-0,381777	0,891624	0,891624
#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!
-0,683207	-0,315797	0,320479	#ДЕЛ/0!	0,320479	0,320479	-0,173942	-0,173942	0,868117	-0,173942	-0,173942
0,713746	-0,695347	0,713746	#ДЕЛ/0!	0,713746	0,713746	-0,807076	-0,807076	-0,107248	-0,807076	-0,807076
-0,302314	0,261082	-0,174643	#ДЕЛ/0!	-0,174643	-0,174643	0,140374	0,140374	0,204224	0,140374	0,140374
1	-0,375091	0,333333	#ДЕЛ/0!	0,333333	0,333333	-0,455312	-0,455312	-0,694133	-0,455312	-0,455312
Amylase	1	-0,9958	#ДЕЛ/0!	-0,9958	-0,9958	0,98494	0,98494	-0,338431	0,98494	0,98494
	BV	1	#ДЕЛ/0!	1	1	-0,98856	-0,98856	0,445438	-0,98856	-0,98856
		BR	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!	#ДЕЛ/0!
			MVB	1	1	-0,98856	-0,98856	0,445438	-0,98856	-0,98856
				MVL	1	-0,98856	-0,98856	0,445438	-0,98856	-0,98856
					CaO2	1	1	-0,324847	1	1
						PaO2	1	-0,324847	1	1
							Cons. O2	1	-0,324847	-0,324847
								PaO2/FiO2	1	1
									Ca-v	1

The PHUAS system calculates automatically for individual patient correction of water-electrolyte and acid-base balance, creatinine clearance, and in case of the predicted blood loss - volume of infusion solutions for hypervolemichemodilution (Figure 3).

Figure 3: Calculation of corrective therapy (fragment of PHUAS)

Corrective Therapy								
K+	16,8	1,24	2,48	-12,4	-11,844	0	0	3%KCl (ml)
Ca++	20-30	mmol/l					10 ml 10% CaCl2 =9 mmol Ca++	
Trisamin	-360	-620	-372	-248	0	0	0	3.6% ml
Na+	43,2	74,4	37,2	14,88		0	0	10%NaCl (ml)
NaHCO3	-120	-206,66667	-124	-82,666667	0	0	0	8.4%NaHCO3 (ml)
4%HCl	-64,8	-111,6	-66,96	-44,64	0	0	0	Met.alkalosis (ml)!
Creat.Clearan	445,545455	460,39697	460,39697	440,37971	467,822727	#ДЕЛ/0!	#ДЕЛ/0!	80-160 ml/min
Am. of plas.	-48	148,8	0	347,2	50,4	0	0	(ml)
Am. of alb.	-189,20448	35,723904	2,976	35,723904	-13,650336	0	0	10% Albumin (ml)
Corr. Infusion	1970	1099	1199	699	213,5	-200	-200	ml
Vgl for K	-192	124	99,2	396,8	388,08	0	0	ml 10% Gluc.
Hyp. deg.	-1,5882353	-2,8181818	-1,3576642	-0,5314286	1,03561644	#ДЕЛ/0!	#ДЕЛ/0!	(l)
Hyper.deg	-0,5070423	-0,8732394	-0,4366197	-0,1746479	0,35492958	0	0	5% Glucose (l)
Isot.deg.	3	0	0,351417	-0,4275862	0,7875	#ДЕЛ/0!	#ДЕЛ/0!	(l)
Vinf.(olig)	2950	3050	2950	2950	2150	950	950	
Pol.solution	90							ml/h!!!
Calculations for hypervolemic hemodilution								
TVG	1575	ml	Safely until reduced hemoglobin and increases the MVB!!!					
10% Alb	630	ml						
Ringer	945	ml						

Effectiveness of the program requires of basic clinical and biochemical parameters of the body that includes common clinical and biochemical analysis of venous and capillary blood, urine.Alsoit needs information about the water exchange in day, weight, arterial pressure, respiratory rate, heart rate and body temperature. When the patient is on artificial ventilation, it requires the mode of ventilation of lungs. Based on assessment of the PHUAS program the physician could determine objectively and reliably the main syndrome of disease, the most important biochemical parameters in individual patients and alsoapply these data for estimation of algorithm of the patient'sseverity (Figure 4).

	Parameters	Estimated-point algorithm									Date		Date		Date		Date	
№	PHUAS	0,75	0,3	0,2	0,1	0	0,1	0,2	0,3	0,75	12.01.2014	Scores	26.03.2010	Scores	21.02.2005	Scores	26.11.2014	Scores
1	ΔV	<-800	-600-800	-600-400	-400-200	0±200	200-400	400-600	600-800	>800	204	0	494,9	0,2	1740,5	0,75	1181,5	0,75
2	IWB	<15	15	16	17-19	20-25	26-28	29-30	>30		38	0,3	35	0,3	46	0,3	40	0,3
3	Blood gluc	<2,3	2,4-2,7	2,8-3,1	3,2-3,4	3,5-5,5	5,6-7,5	6,6-9,0	9-14	>14	6,6	0,1	4,1	0	3,3	0,1	5,7	0,1
4	Osm. blood	<240	240-265	266-269	270-279	280-293	294-300	301-315	316-400	>400	296,62	0,1	283,48	0	287,36	0	291,54	0
5	COP	<15	15-16	17-18,9	19-20,9	21-25,9	26-27,9	28-30	30-32	>32	28,248	0,2	28,38	0,2	27,06	0,1	27,192	0,1
6	ΔHb	<-18	-18-16	-15-8	-7-3	-2÷2	3-7	8-15	16-18	>18	-4	0,1	-5	0,1	3	0,1	-10	0,2
7	Platelets	<140	140-159	160-179	180-249	250-300	301-320	321-350	351-400	>400	188	0,1	196	0,1	400	0,3	132	0,75
8	TPVR	<900				900-1400	1401-1800	1801-2400	2401-2800	>2800	2154,60	0,2	1781,88	0,1	1321,98	0	1708,84	0,1
9	Total Bil.					8,5-20,5	20,6-22,9	23-28	28-39	>40	11,5	0	26,3	0,2	10,5	0	11,4	0
10	KdRittis		<0,5	0,5-0,54	0,55-0,59	0,6-0,8	0,81-0,9	0,91-1,2	>1,2		1,44	0,3	1,56	0,3	0,46	0,3	0,92	0,2
11	K+	<3,0	3,0-3,2	3,3-3,5	3,6-4,1	4,2-5,5	5,6	5,7-5,8	5,9-6,0	>6,0	4,65	0	4,7	0	4,7	0	3,45	0,2
12	Heart Vol	<38	38-42	42-49	50-54	55-90					86,614815	0	89,770541	0	110,91679	0	95,667965	0
13	tcoagul.	<3	3-4	4,1-4,4	4,5-4,9	5-10	11-12	13-14	15-16	>16	7	0	6	0	7	0	8	0
14	NII					до 0,1	0,11-0,29	0,3-0,6	0,7-0,9	>1,0	0,18	0,1	0,13	0,1	0,06	0	0,10	0
15	Shok Index		<0,48	0,48-0,5	0,51-0,53	0,54	0,55-0,7	0,71-0,9	0,91-1,0	>1,0	0,31	0,3	0,38	0,3	0,46	0,3	0,38	0,3
16	Nonspec/sp					до 2	2,1-2,9	3,0-3,5	3,6-3,8	>3,8	1,37	0	2,44	0,1	1,07	0	2,92	0,1
17	Denurine		<1008	1009-1010	1011-1013	1014-1028	1029-1031	1032-1034	>1034		1015	0	1015	0	1005	0,3	1015	0
18	U/C	<6	6-7	8-9	10-11	12-20					11,43	0,1	7,90	0,3	14,00	0	16,85	0
19	Consum. O2	<110	110-119	120-139	140-179	180-280					161,94	0,1	212,86	0	259,56	0	195,11	0
20	PaO2/FiO2	<330	330-399	400-429	430-445	446-455	456-460	461-465	>465		456,87	0,1	488,24	0,3	482,53	0,3	476,83	0,3
									Dynamics:		Total:	2,1	Total:	2,6	Total:	2,85	Total:	3,4
											I Phase		II Phase		III Phase		IY Phase	
	The severity of the general condition of the patient and the risk of acute disorders of the vital functions of the body by the sum of points:																	
									0-2 low risk (preventive action), satisfactory condition									
									3-4 - medium risk (recommended medical therapy), a state of moderate severity									
									> 5 high risk (drug therapy is required), a serious condition									

The developed algorithm scoring allows determining the risk of danger of the disease, identifying the degree of clinical severity of the general condition of the patient, finding out the best financially and clinically effective way of prevention and treatment, complex assessing of the quality of the therapeutic and preventive measures.

The main components of the program are systemic approach, real access to health care and social rehabilitation, regardless of gender, age and social status. Also, PHUAS provides independence, the constancy of the diagnostic and therapeutic processes, allows control the volume, quality and timeliness of delivery of health services and their compliance with medical standards.

Also, the advantage of the program is not only fast and objective examination of large number of people, early identification of risk groups with severe condition, determining optimum and effective options for prevention and treatment of disease, retention of time and money for the survey, but also an ability for using the data for their correlation with external factors the environment (ecology, nutrition, addictions, vaccinations, pharmacotherapy, etc.).

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